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Sluicing Earth Behind Sheerboards in Early Stages of Construction of Seattle Stadium

Build Large Earth-Fill Stadium by Sheerboard Method

Novel structure for students of University of Washington has concrete steps placed directly on earth formed to proper shape behind sheerboards—will have reinforced concrete superstructure when completed.

Abstracts of American Concrete Institute Papers

Some Unsettled Points in Structural Design

Engineering judgment applied to a dozen open questions on columns, beams, grillages and crane girders.

By R. Fleming

Industrial Conditions in Soviet Russia

(From *Engineering News-Record's* Berlin Correspondent)

Federal Cement Tile Withstands The Acid Test

Detroit Pressed Steel Co.

MANUFACTURERS OF
AUTOMOBILE FRAMES
STEEL STAMPINGS

PHONE RIDGE 4100

1600 MT ELLIOTT AVENUE
Detroit

May 15th, 1919.

Federal Cement Tile Company,

Chicago, Illinois.

Gentlemen:

We have, this day, tested two of your Standard Red Pitched tiles which were taken from our Pickling Building, which has been in continuous service. One tile bore the date of May 5th, 1915, and was coated on the underside with asphalt paint. The other was dated August 10th, 1917, which was an addition to the Pickling Building and was not painted on the underside.

The first tile broke under a uniformly distributed load of 3800 pounds and the second one at 3900 pounds. We found the reinforced metal clean and bright in every respect after the tiles were broken into many pieces.

The concrete was also in good condition and we were pleased to learn that the carrying capacity of the slab had increased about seventy percent over tiles 30 days old.

Trusting this will be of service to you, we remain

Yours very truly,

DETROIT PRESSED STEEL CO.

John M. Bischoff

Construction Engineer.

JMB-IT

Another Example of Federal Roof Permanence

Acid fumes in the Pickling Room of the Detroit Pressed Steel Company have eaten their way into the underlying steel work, but the Federal Cement Tile in the roof are stronger than the day they were installed, as stated in the accompanying letter. This is merely an added proof of Federal Indestructibility under unusually severe conditions.

Make your new roof *proof against fire, weather acid fumes and age.*

"The Indestructible Roof"

FOR FLAT and PITCHED SURFACES

Made, Laid and Guaranteed by

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*

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A New Way to Build Stadiums

REMARKABLE CONFIDENCE in the stability of a fill placed hydraulically behind sheerboards was displayed in the construction of the Seattle Stadium, described on another page. In the largest of the filled stadiums, the Yale Bowl, the engineers would not venture a concrete structure of any sort on the new fill, but at Seattle the concrete stepped seats were not only placed directly on the earth but were put there immediately after the fill itself was placed; as soon, in fact, as the sheerboard stakes could be removed and the concrete placing machinery moved along. So far there has been no sign of any movement in the fill or crack in the concrete which would indicate an early settlement in the fill. If stability is assured, as it appears to be, the method offers many attractive features for stadium building, an activity which seems now to be reviving after some years of desuetude. The detail which is most essential to this process of filling, that is the stepped sheerboards, is made a part of the stadium structure, whereas in dams and regrades, where the method has been heretofore used, these steps have to be cut down or covered up. The step structure being automatically formed, as it were, the production of the concrete seats and the steps themselves becomes simple and cheap. At Seattle speed requirements were so great that cost records are not very informing but the simplicity of the method, the apparent stability of the concrete covering of the fill (on which a year from now we will have better evidence) and the construction speed possible demonstrate that where proper material and topography are available the process is worth considering.

Motor Vehicle Registration

FOR HIGHWAY ENGINEERS the American Automobile Association's figures on the registration of motor vehicles in the United States in 1920 (see p. 330) furnish a definite, and therefore an exceedingly valuable, index of the growth of traffic during the past year. They supply, also, a basis of forecasting, by comparison with statistics of former years, the magnitude of the problem which road builders face if the rate of increase in the number of passenger and commercial cars is to continue in the future as it has in the past. The total of 9,180,316 automobiles and trucks using the public highways during 1920 represents a record gain of 2,114,870, or about 30 per cent in a single year, giving the United States one motor vehicle for every 11 persons. These facts are of immediate concern to state and county highway organizations. One very important indication of the statistics is the rapid increase in the commercial vehicle registration. Last year the total number of trucks was 945,826, as compared with 750,000 reported for 1919 by the National Automobile Chamber of Commerce. This means, of course, a greatly increased tonnage over previous years and consequently that the roads are being called on to perform a heavier duty. The statistics serve to emphasize the importance of the traffic problem and the obligation of keeping pace with reasonable demands. Another clear inference from the statistics is the need in every state for legislation which, without unreasonably impeding the development of motor vehicles, will place restrictions on weights, sizes and speeds so that a comparatively few enormously heavy trucks may not destroy a capital investment running into millions of dollars.

F. A. E. S. Under Way

NOT merely because the federation at its Syracuse meeting last week elected its secretary, is one prompted to say that the Federated American Engineering Societies is now under way. The election, it is true, was the concluding part of the organization work. That which gave at Syracuse a stronger sense of substantial progress was the virility of the council meeting. There was a definiteness of purpose, a clearness of conception and a determination that left little doubt in the minds of those present that the handling of the organization will be such as to secure widespread approval. Necessarily its policies are largely unformed, its work has hardly been begun, but so far as the signs in a budding organization are indicative they are decidedly hopeful.

Local Society Strengthening

ONE of the outstanding features of the Syracuse meeting was the strong emphasis repeatedly placed upon the need for decentralizing the engineering organizations of the country and of building up, not half a dozen strong centralized organizations, but rather many strong local bodies. This crystallizing sentiment will, we know, be received with hearty approval in the profession. It will secure especially strong endorsement among the civil engineers, for much of the recent controversy in their national organization has centered about the efforts of those who believe that the greatest future of the society lies in making it strong in every part of the country. Moreover, those who successfully fought the entrance of the civil engineers into the federation maintained stoutly that the influence which the engineering profession needs with the public is to be exercised chiefly through local and state action. In fact, in the course of the discussions there was strong endorsement of the idea of local and state councils which would handle all but a very few problems. These few, being of national scope, would pass to a central body, which, having but limited functions, could be run at small expense, thus avoiding the building up of a large overhead organization which, as the opponents contended, would be going into the highways and byways to find work for itself. The decentralizing policy is an entirely sound one and it is gratifying to find

in the early meetings of the federation's council a strong sentiment directed toward such a functioning as will enable the federation to be of chief service by building up and strengthening local societies in every part of the country. Incidentally, we feel that if this policy be followed it will be a strong factor in the early conciliation of the civil engineers toward the federation movement.

Grouping Railroad Systems

PERMISSIVE consolidation of existing railroad companies into a limited number of large competitive systems is one of the functions of the Interstate Commerce Commission under the Transportation Act. The subject has attracted much attention in financial circles during the past few months and rumors have been rife. Moreover, it is a matter that concerns engineers in the light of possibilities for improved terminal arrangements through unified operation. Therefore, the difficulties being encountered in England during preliminary negotiations for grouping the railroads into a few large systems are of more than passing interest. As noted elsewhere in this issue, the principal of grouping has been accepted by the British companies, but there is strenuous objection to some of the measures for refinancing and compulsory consolidation. At the same time it is intimated that grouping of some kind will actually be effected in 1924, three years after the companies will have passed from government operation. Although conjecture as to consolidations here has been a popular pastime for some months, the indications are that some time will be required actually to carry them out. In the meantime we may well profit by England's experiences.

The Concrete Institute

AT its very successful meeting at Chicago last week the American Concrete Institute justified its existence. There were gathered there a number of men from each of the groups whose joint knowledge and experience are needed to make a success of any concrete job—the research man who studies behavior and properties, the engineer who designs and superintends the structure, the contractor who builds it and the material man who furnishes the elements out of which it is formed. It is the peculiar function of the institute at its annual meeting and in its committees to bring these men together in cordial co-operation and with mutual understanding, and this function is no part of any other society. Each one of the groups has its own organization and some of the national societies include two or three, but nowhere else may be expected a conjunction of all those concerned with concrete work. The proper development of concrete needs just this co-operation. In spite of its extensive use it is a strange material whose properties are none too well known and whose peculiarities are none too widely appreciated. Individual work and study of the material itself and the structures into which it goes are good and necessary, but the experimentation and the theory and the practice of its use are so closely interwoven that it is only when they are studied together that the most useful results may be expected. The institute is doing a unique and necessary work for one of the two foremost building materials and in so doing it deserves the aid and co-operation of every one interested in that material.

Road Builders' Convention

THE American Road Builders' convention at Chicago week before last was a gratifying success. Compared with the convention a year ago at Louisville it exhibited a marked revival in interest and attendance. This result has required hard work. Continued effort must be made by the association's leaders if the gain made in 1920 is to be retained during 1921. They should have more help from highway engineers. The attendance and active participation of a greater number of men prominent in planning and directing highway development is needed. At Chicago few of the leading state highway officials were present. In absenting themselves these men missed the only opportunity which they have in public convention of carrying educational work to contractors, manufacturers of equipment and materials producers. Incidentally, they neglected an opportunity for acquiring information furnished by a notable exhibition of road-building machinery and materials. For years there was much strongly expressed dissatisfaction with the association. Nevertheless, despite its loose management and lack of virility, the association has remained the only agency in the field to bring together the various related highway interests. That being the case its convention deserves larger support, to the end that it may grow into a body that will fully and satisfactorily co-ordinate all the agencies pertinent to the design, building and maintenance of good roads.

The Engineer—Key Man of Industry

FAVORABLE COMMENT was made in these columns recently on the reception accorded to an economic paper presented by Francis H. Sisson before the annual meeting of the American Society of Civil Engineers. An equally enthusiastic reception will be given, we are sure, to the paper in this issue by Herbert Hoover. The other address was to an extent a detached presentation, that is to say, it gave a picture of the effect of the economic situation on the individual. Mr. Hoover's angle is exceedingly direct. He fits the engineer into the picture, and shows him how and why he is in a position to improve the whole economic functioning of the nation. Seldom has the engineer's place in the economic structure been delineated in such strong lines, seldom has the vision been broader.

In the very introduction Mr. Hoover sets forth the reason for the engineer's strategic position and the platform on which his public work is to be done. Engineers penetrate "every industrial avenue and thus possess a unique understanding of our many intricate economic problems and an influence in their solution not equalled by any other part of the community. Wanting nothing from the public, either individually or as a group, they are indeed in a position of disinterested service."

Following those statements comes the thesis of the industrial survey, the first great public work of the Federated American Engineering Societies, *"to visualize the nation as a single industrial organism."*

The survey is just beginning. It is a big and a difficult task. It will take the best brains of the profession to pull out of the data gathered a plan or suggestions that are so patently workable that they will appeal to employers and employees and so eventuate with reasonable speed in practical results. But Mr. Hoover has never been known to terminate his efforts in

theorizing. He is above all a man of action. Despite the largeness of the task, therefore, his leadership is a guarantee that there will be fruitful results.

Such a task well carried through would do much to crystallize in the public mind the place that the engineer occupies in the industrial structure. We know that that structure is built on the engineer and his works, but we have never made our position so dramatic that the public has caught the fullness of the idea. That is what the federation's work promises to do.

A Construction "Get-Together" at Philadelphia

PARTICIPANTS in the conference of all the elements in the construction industry, held last week in Philadelphia, and whose deliberations are recorded in the news section of this issue, not only had the advantage of getting the other fellow's point of view, but unanimously subscribed to a program which, if vigorously followed, should revive and stabilize construction work and re-establish the public confidence in the construction situation. The conference was sponsored by the industrial relations committee of the Philadelphia Chamber of Commerce, and to it were invited *and did come*, bankers, materials manufacturers and employees and employers in every skilled building trade.

Every element in the industry was given the opportunity of explaining its particular situation. Each was the target of criticism from other elements: The banker on account of the difficulty and expense of financing house construction; the materials manufacturer, for excessive costs; the employer, for an unintelligent labor problem; the laborer, on account of inefficiency and high wages. But every man carried away an understanding of the other fellow's position and a realization that only through co-operative effort to "cut the corners" in construction costs, could the present stagnation be overcome.

The conclusions reached by the conference were: That neither building materials nor wages had deflated proportionately to other commodities; that costs of first and second mortgages were excessive; that every element in the industry must, for the moment, submerge its personal advantage. In other words, the manufacturer must, for the emergency, sell at cost. The contractor must forget his profit. The laborer must consent to wage reduction.

Certain salient facts were brought out: That construction—outside of public works construction—was practically at a standstill; that the laborer was surely worthy of his hire; that $1,800 a year was a minimum wage for the skilled mechanic; that the average working year of the mechanic was 200 days; that unemployment in the building trades was large, and that many contractors were doing jobs at cost in order to keep their organizations intact. The employees' attitude was that, because of the short working year, they could not now afford a reduction in wages. But it was apparent that, if other elements were willing to make sacrifices, labor would do its share. A start was made by the promise of a brick manufacturer to forget even the interest on his $500,000 plant in selling stocks in hand, and of an investing builder that he would build 100 six-room, two-family houses at cost if the mechanics would do the financing.

Detailed conferences are to follow, and immediately, in which the shaving in costs all around, it is hoped, will be accomplished. The various elements now know each other. They can now get together "with their feet under the same table."

Philadelphia has a golden opportunity. It has the chance to point the way in co-operative construction, not merely as an emergency arrangement, but as a permanent condition. It has brought the employer, employee, manufacturer, dealer, banker togeth Common aims have been found, and the ground work laid for a harmoniously co-operating building industry. The result will be awaited with interest.

Railroad Wages Upsetting to All Industry

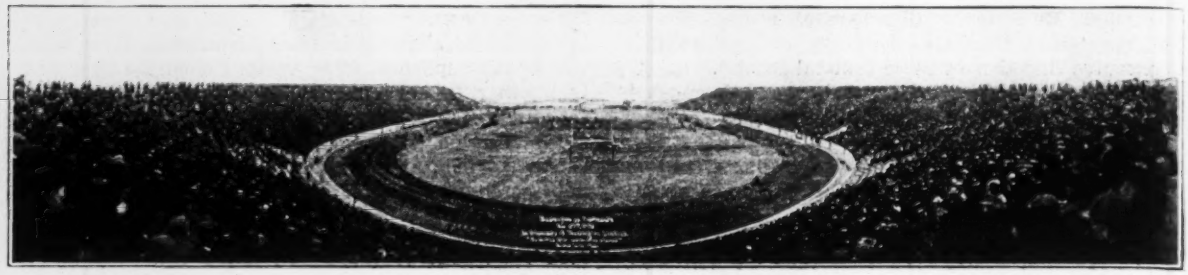
THERE is an aspect of the railroad working agreements and of railroad wages, the first of which are now in controversy before the Railroad Labor Board at Chicago, on which sufficient emphasis has not been laid, namely, that they are a disturbing element to every single industry. Railroad wages were standardized for the whole country during the war, and the wages for a given duty were fixed in order to be adequate to the living expenses in our largest cities. As a consequence, the railroad employees in smaller communities find themselves enjoying wages in excess of the prevailing rate. Naturally, railroad wages, having government sanction, are used as an argument for resisting wage decreases by other workers and thus constitute a disturbing and seriously conflicting element in the wage deflation that must, if a proportionately high efficiency cannot be obtained, be deflated with living costs. In this way railroad wages are of very direct concern to every industry. Contractors will probably feel their pressure when work opens up.

It is not to be expected that the railroad wage levels will be successful in preventing declines in all lines, but they will be a constant source of soreness among workers and of friction with employers In the long run railroad wages cannot stand materially above the general level, but, fortified by national agreements made by an administration notorious for its indulgence toward the railroad employees, they will present a strong resistance to recession.

No less disturbing than the wages themselves are some monstrous provisions of the working agreements. They are demoralizing to the men themselves and to all neighboring workers. The heavy payments for overtime encourage the stretching out of work, while under certain conditions idle time is paid for beyond any reason. It is conceded that the working conditions in railroad employ present variables, due to vicissitudes in handling trains and variations in traffic, not present in employment in factories. These must be cared for in setting wages, but government control was made the instrument for securing entirely unwarranted concessions. Among the glaring concessions was the substitution of straight time for the piecework system in shops.

Put in a word, the railroad agreements ignored entirely the doctrine of payment for results. Time only has been the consideration.

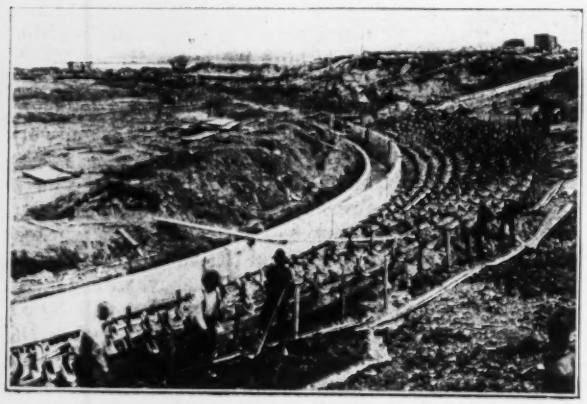
If the public generally can be given a true picture of what has happened in the field of railroad employment its pressure can be counted on in helping to bring about a reasonable adjustment of conditions that place a heavy burden on both the railways and the public.



Build Large Earth-Fill Stadium by Sheerboard Method

Novel Structure for Students of University of Washington Has Concrete Steps Placed Directly on Earth Formed to Proper Shape Behind Sheerboards — Will Have Concrete Superstructure

ATHLETIC stadiums of large size are becoming quite common; hardly a university of any pretension but what has one in service or projected and many municipalities have built them for general use. Most of these structures—all of any size except the Yale Bowl and the San Diego Municipal Stadium—have been of reinforced concrete with grandstands supported on framed bents. There has just been completed at Seattle, Wash., for the University of Washington, a stadium of radically different structural detail; a hydraulic fill of earth shaped by means of sheerboards with



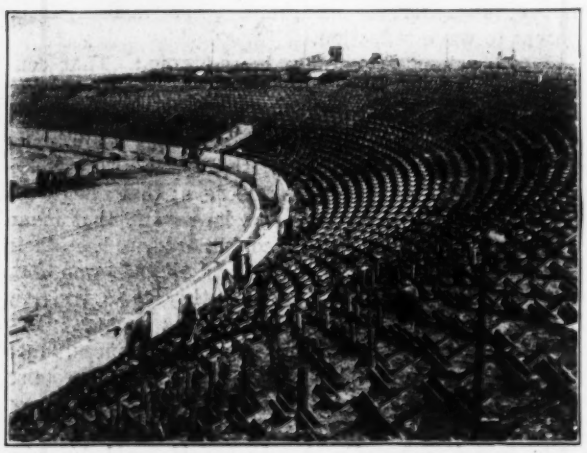
SHEERBOARDS IN PLACE FOR FILL AT END CURVE

the reinforced-concrete steps placed directly on the earth. The site of the stadium was a barren waste on May 17, 1920, when work was started. The intersectional Dartmouth-University of Washington footfall game was held in it on Nov. 27, 1920, and the view of the game herewith shows a completed structure seating approximately 28,000 persons. No little part of the interest in the structure is due to this rapidity of construction.

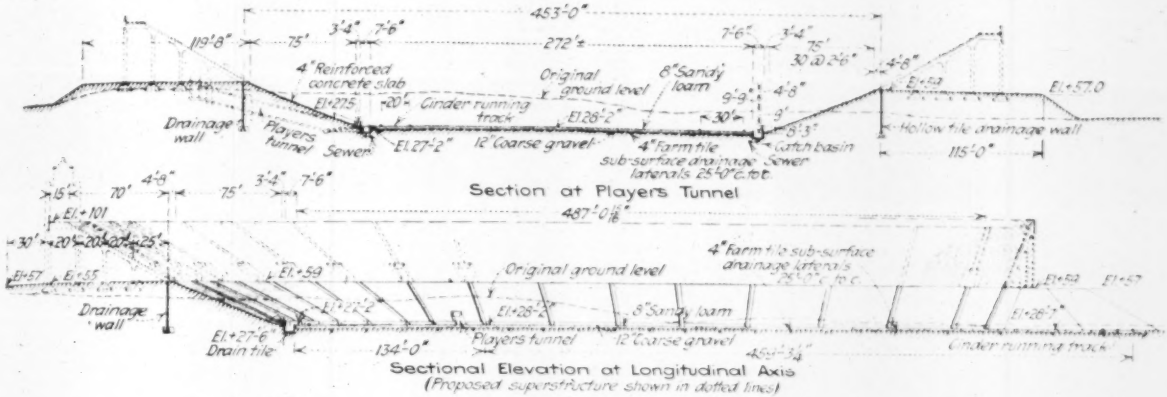
The University of Washington stadium is horseshoe shape with a slight bend toward each other of the long sides in order to give that impression of crowd unity which is peculiar to completely curved structures such as the Yale Bowl. It is open at one end in order to provide space for long distance straightaway running and also to take advantage of the view of Lake Washington on the bank of which the stadium is located. The playing field is from 268 to 293 ft. wide and 487 ft. long measured from the middle of the curved end to the end of the seat section. The seats themselves are on an approximate 1 on 2½ slope, extend back 75 ft., so that with the distance assigned to the "moat," which surrounds the field, the out-to-out width of the top seat banks of the stadium is 474 ft. Eventually there will be built on the top of the present slope additional seats of the conventional reinforced-concrete frame type. When these are added the seating capacity will be 60,000.

Surrounding the field and separating it from the seats is the moat just mentioned. This is a passageway lined with reinforced-concrete walls 6 ft. wide inside and about 4 ft. below the playing field level. It is entered under the stands by a reinforced-concrete tunnel and serves during the games to keep the spectators off the field and to permit any one to get to any part of the field without crossing it. When the stands are emptying temporary wooden bridges can be thrown across to permit people to get out onto the field. Normally, however, the stands are entered and left from the top, which, as will be noted, is not very much higher than the surrounding country. When the additional stands are built there will be the usual passages and stairways leading in from the present fill level.

The seats are reinforced-concrete slabs 4 in. thick, reinforced with longitudinal and transverse ⅜-in. rods spaced 8 in. center to center. They are in sections approximately 45 ft. wide on the sides and 29 ft. at the end separated by a 3-ft. aisle in which the steps are



FORMS FOR SHEERBOARDS IN PLACE AFTER FILL HAS BEEN MADE



SECTIONS THROUGH NEW UNIVERSITY OF WASHINGTON STADIUM AT SEATTLE

built with shorter risers than in the seat banks. The seat banks vary in riser height from 11 in. at its bottom to 14 in. at the top, but have a uniform tread width of 2 ft. 6 in. This gives a curve of slope which was worked out with the intention of making all parts of the field visible to all spectators. Particular attention was paid to making it possible for everyone to see the feet of a runner on the cinder track which is close to the parapets of the moat. On these concrete seat banks there are special benches made up of timber plank bolted to special cast-iron frames. These timbers, of Oregon fir, 2 x 10 in., dressed four sides, are given one treatment of hot oil. In the curved section of the stands the planks forming the seats are curved also.

Expansion in the concrete steps is provided for by a construction joint at the center of each bank. Here a groove is cut into the earth fill and the concrete of the steps returned into this groove, the steel reinforcement being turned down into the groove and the concrete poured there against a separation board. The seat banks are laid and poured in groups of three steps vertically, a separation joint being made along the riser of every third step.

Especial attention is paid to drainage of the steps. Each step is sloped from the front toward the back and a groove made in the tread against the riser, this groove sloping from nothing at the middle of the bank to its full depth of about an inch at the aisle. Water drains back to the groove and down to the aisle which are sloped outward. The drainage then reaches the moat through the openings in the parapet at each aisle and flows through catchbasins into the sewer below the moat, which sewer leads to the lake.

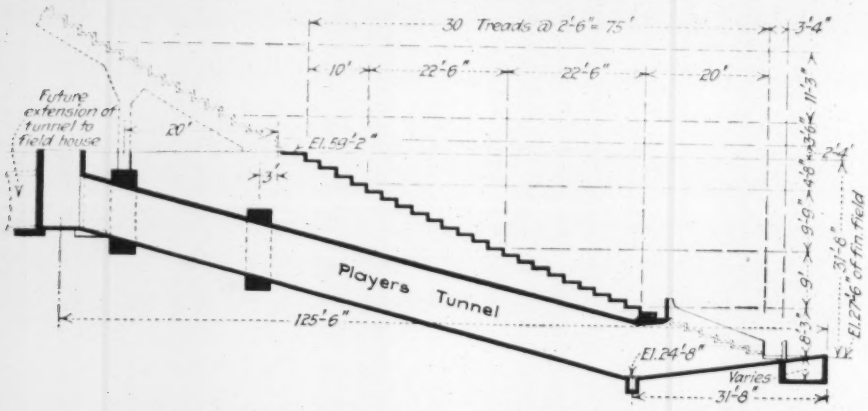
The field itself is underlaid with 4-in. drain tile in cross-laterals 25 ft. center to center. These are placed in a coarse gravel. There is then placed a light covering of hogged fuel, that is, the refuse from saw-mill plants, and a 9-in. layer of sandy loam, on top of which is placed the top soil which will be grass covered, except for the cinder running track.

Groundwater is fairly high at the site, so it was thought necessary to cut it off from reaching the field proper. To do this a drainage wall made up of 6 x 12 x 12-in. hollow tile was built continuous around the field and on a line with the top of the seats. This wall rests in a trench filled with gravel surrounding drain tile and open joints. All groundwater back of the wall will be intercepted by the wall and led in by the drains to the sewer which empties into the lake. Part of this wall, about 320 ft. in length, was put in after the fill was placed by excavating a trench, laying up the wall and filling in afterward with puddled earth. The remainder was laid up with the hydraulic fill construction.

As has been stated, the fill was placed by the sheerboard method which had been perfected by Lewis, Wiley & Morse and was used in a Portland regrade and on the Ochoco dam particularly. The latter use has been described in *Engineering News-Record*. Messrs. Lewis and Morse, who have been instrumental in developing the method, are now connected with the Puget Sound Bridge & Dredging Co., the contractor who built the University of Washington stadium.

The stadium site was a barren area immediately adjacent to the campus of the University of Washington and facing Lake Washington. It is of irregular elevation, the high point being perhaps 42 ft. above the

PUMPING FILL ON FIRST SIDE TO BE BUILT



SECTION THROUGH STADIUM AT PLAYERS' TUNNEL

low point. The material is a gravelly clay with very few large-size rocks.

The layout of the stadium was made so as to approach as nearly as possible to a balanced cut and fill, the intention being to excavate by hydraulic giants the earth in the playing field area and to sluice it into place to form the mound for the seat banks, extending this mound, of course, far enough back so as to carry the prospective reinforced-concrete seats. This involved the removal and transportation of 159,319 yd. It was not possible to exactly balance the cut and fill and it was found necessary to bring in 67,994 yd. of truck from steam-shovel excavations about 1,500 ft. away from the site. Nor was it possible to excavate the entire playing field area by hydraulic giants. Toward the end of the work about 26,000 yd. at the open end of the stadium was taken out by steam shovel.

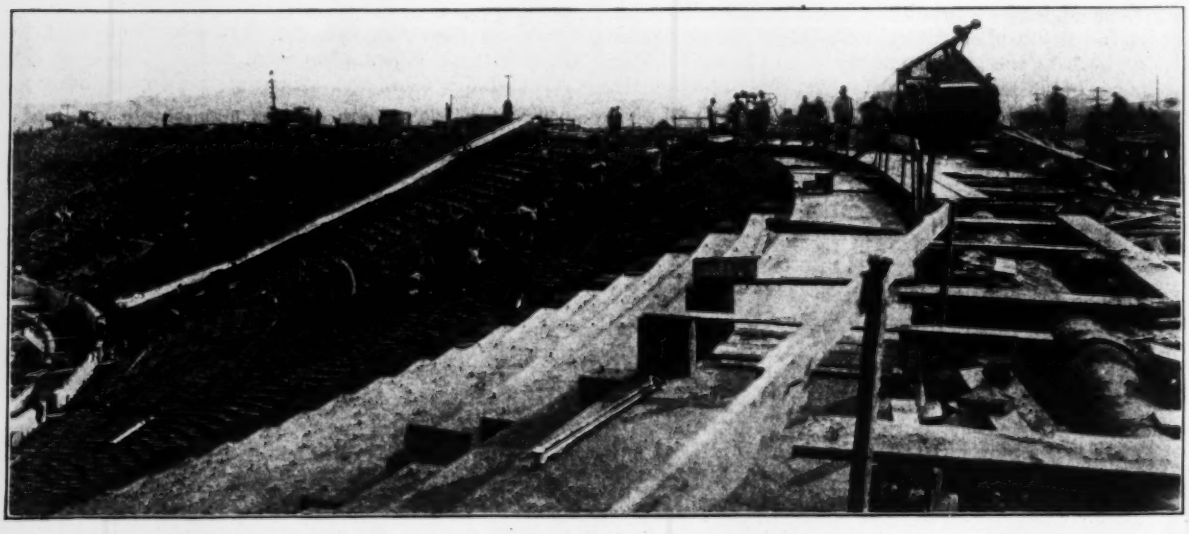
The sheerboard method of fill, as described in the previous articles noted, consists in building up the hydraulically deposited fill stage by stage behind parallel shallow walls of boards, the function of which is to lead the liquid fill in fixed lines at such a rate as to cause it to deposit the carried sand and clay, and also to permit the gradual disperson of the transporting water to a point where it is led away.

Construction on hydraulic fills was started as soon as equipment was installed and enough of main drain constructed to act as wa for booster pump. The ne step was to construct t moat with its sewer, whi was to carry away duri construction the water of t fill. Then hydraulic giant were set to work in the pla ing field tearing down th ground there and into a pip leading to a single-stage, 12 in. sand pump, which pumped the material through a 12-in. pipe line on the upper level of the fill. The discharge from this line was then directed into the lines of sheerboards. As the fill was built up the pipe was raised.

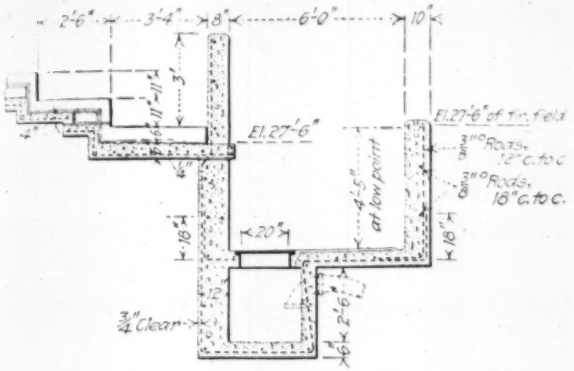
Water for these operations was pumped from a nearby canal by two 5-stage centrifugal pumps of a combined capacity of 6,000,000 gal. per day, these two pumps being direct connected to and driven by a 650-hp. motor. Each pump has a 10-in. discharge delivering water direct to a 24-in. pipe line at 90-lb. pressure, on which were mounted the 4 to 4½-in. hydraulic giants. The views show the nature of the sheerboards. As the fill is built up, 2 x 4-in. stakes, about 5½ ft. long are driven into the ground and are cross-braced the width of the seat benches, that is, 2 ft. 6 in. apart, by small wooden bridges. On the side of the 2 x 4-in. stakes, then, are nailed the 1-in. sheerboards to the exact height of the required rise of the steps.

The fill builds up in the trough formed between the sheerboards, each one of which is the proper height above the one next below it to make the proper rise in the steps, and when the fill has reached the bottom of the sheerboards the next higher sheerboard is placed. The final stage of this operation is reached when the top of the fill is made. At that time the bridging is removed and the stakes pulled by a small tripod stump puller, but the sheerboards themselves are left in place to serve as forms for the concrete steps.

The fill so placed was almost immediately solid. In fact the workmen could walk on it while it was being



COMPLETED SEATS IN FOREGROUND—CONCRETING IN PROGRESS IN BACKGROUND



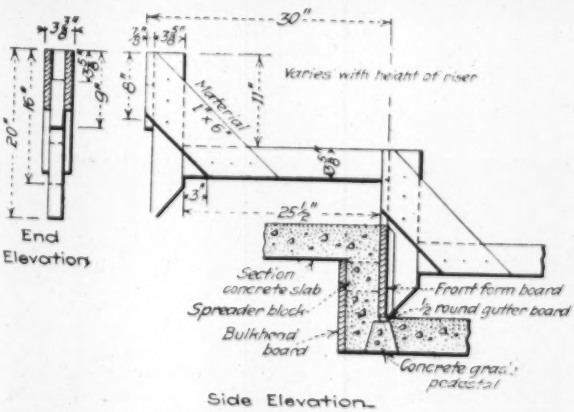
DETAIL OF MOAT AND FIRST STEPS

placed and it showed practically no water content the day after the water is taken away from it. It is so solid that it was possible to follow immediately behind it, that is at a minimum interval of 3 to 6 days, with the concreting. An instrument check shows that no settlement took place in the hydraulic fills after the placing of the concrete.

The procedure here was first to lay the ¾-in. reinforcing on the earth fill continuous for the three steps which form a unit and bent over into the construction joint at the middle of each bank. A concrete mixer movable clear around the stadium was then mounted on the top of the fill and material brought to it by trucks on the upper level. From this mixer, mounted as shown in one of the views, chutes are run down the incline and the concrete poured continuously from the bottom to the top, portable light forms being used for the outside form of the riser. The tread, of course, can be screeded off.

An accompanying sketch shows the method used in placing the front forms on the seat bank section and the method of bracing. These braces or jacks are readily removable and can be used on other portions of the work. The front form board is set on small concrete pedestals resting on the earthfill tread. There the jack or brace is placed between two cleats nailed to the form and a spreader block inserted between the front and back form boards, the back form board being the original bulkhead board. This spreader is removed as the concrete is tamped in place, but the concrete grade pedestals for the front form boards are cast into the slab.

At the same time the anchor bolts for the seat

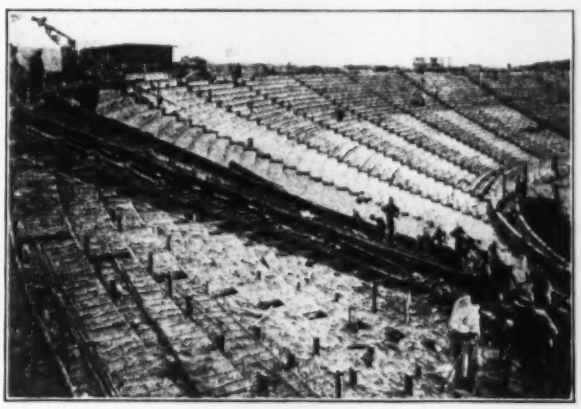


DETAIL OF FRONT FORM FOR CONCRETING STEPS

frames were placed so that as soon as the concrete has received sufficient set, a minimum period of 24 hr. being allowed, the vertical forms could be stripped, the stakes pulled and the benches put in place.

The outside slopes of the mound and the curved end slopes were left in steps formed by the sheerboard method, but the sheerboards were pulled at these locations and the whole surface spaded down by hand into an even slope.

This method of placing gives a remarkably accurate forming to the steps. In fact in only a few cases was it necessary to make any change whatever to the earthwork in order to accommodate it to the proper design shape and slope. In the case of the aisles, however, where the steps are different than on the seat slope, it was necessary to cut out the earth fill by hand. This was quite readily done and the steps cut to the proper section for the concrete.



REINFORCEMENT IN PLACE ON NEW FILL

The idea for a stadium of this sort was originated by the students of the University of Washington and was financed by the Associated Students, an undergraduate body. A special campaign for raising funds, in which long-time season tickets played an important part, proved to be very successful. Then general design for the stadium was in the hands of Bebb & Gould, architects of Seattle, with Henry Bittman, of Seattle, consulting engineer. The construction was entirely in the hands of the Puget Sound Bridge & Dredging Co., the sluicing department of which is the former firm of Lewis, Wiley & Morse. For this company William H. Lewis was manager and W. C. Morse chief engineer. To them is most of the credit due for the particular type of structure.

Airplanes and Forest Fire Control

Of the 196 forest fires sighted and reported in 1920 by airplanes out of Sacramento, Cal., 33 per cent were located within a quarter of a mile of the area determined later by surveys on the ground. Ten per cent of the total number of fires were discovered by the air patrol before the rangers were aware of them. Forty-two per cent were reported by radio, while the planes were in the air. The planes were also used to direct fire fighting operations and to patrol fire lines which were built but needed watching. If the planes reported a line to be clear, fire fighters were kept elsewhere, but if the observer reported that the fire had broken away a force of men could be rushed to the spot at once.

Motor Vehicles in United States Number 9,180,316

OFFICIAL figures compiled by the American Automobile Association indicate that there were 9,180,316 passenger and commercial motor vehicles registered in the United States during 1920, of which approximately 8,234,490 were for passenger use and about 945,826 were commercially employed. During the same period 271,230 motorcycles were also registered. The total receipts from registrations amounted to $99,141,097.

In two states, namely, California and New York, the figures given in the accompanying table cover only the first 11 months of the registration year ending Feb. 28, 1921. The total registrations for the year will therefore exceed 9,300,000 cars and receipts will probably reach $100,000,000.

MOTOR VEHICLE REGISTRATION IN UNITED STATES IN 1920

	Passenger	Commercial	Total	Motor-cycles	Gross Receipts
Alabama	61,941	12,696	74,637	1,035	832,980
Arizona	30,559 (a)	4,000 (a)	34,559	750	191,577
Arkansas	55,582	3,500	59,082		590,820
California (f)	534,814	34,078	568,892	20,047	5,554,265
Colorado	121,212	7,728	128,940	3,364	818,775
Connecticut	95,150 (a)	23,950 (a)	119,100	4,375	1,852,591
Delaware	16,500 (a)	1,800 (a)	18,300	674	329,980
Dist of Col (b)	44,855	6,826	51,681	2,648	223,588
Florida	64,185	10,439	74,624	1,275	554,695
Georgia	132,000 (a)	14,000 (a)	146,000	1,382	1,918,512
Idaho	48,850 (a)	2,000 (a)	50,850	763	882,271
Illinois	504,240	64,674	568,914	10,368	5,780,612
Indiana	300,226	32,481	332,707	8,823	2,029,103
Iowa	407,030 (a)	30,000 (a)	437,030	4,000	7,487,830
Kansas	268,159 (a)	26,000 (a)	294,159	2,972	1,399,272
Kentucky	99,417	13,258	112,675	1,546	815,941
Louisiana	65,000 (a)	5,000 (a)	70,000	500	400,000
Maine	55,600	7,600	63,200	1,590	820,000
Maryland	100,313 (a)	12,000 (a)	112,313	5,194	2,124,925
Massachusetts (c)	253,245	51,386	304,631	15,143	3,860,232
Michigan	366,946	45,771	412,717	8,011	5,494,486
Minnesota (d)	204,300 (a)	19,400 (a)	223,700	7,550	1,067,737
Mississippi	60,000 (a)	4,000 (a)	64,000		425,000 (a)
Missouri	273,308 (a)	23,700 (a)	297,008	3,954	2,111,697
Montana	59,450 (a)	1,200 (a)	60,650	675	416,245
Nebraska	200,000	19,000	219,000	2,100	2,039,330
Nevada	9,963 (a)	500 (a)	10,463	140	103,318
New Hampshire	30,240	4,440	34,680	2,542	542,457
New Jersey	204,125	23,612	227,737	11,041	3,503,936
New Mexico	16,100	6,000	22,100	219	200,000
New York (f)	559,521 (e)	124,398	683,919	69,349	8,817,709
North Carolina	127,405	13,455	140,860	1,418	1,765,030
North Dakota	88,385	1,455	89,840	898	681,059
Ohio	538,000	82,600	620,600	19,400	6,400,000 (a)
Oklahoma	204,000	9,000	213,000	1,600	230,000
Oregon	93,790 (a)	10,000 (a)	103,790	3,517	2,085,000
Pennsylvania	521,835	48,329	570,164	23,981	8,090,873
Rhode Island	40,768	9,563	50,331	2,223	451,062
South Carolina	83,618 (a)	9,200	92,818	908	527,868
South Dakota	113,000	9,000	122,000	560	768,000
Tennessee	90,214	11,638	101,852	1,151	1,214,000
Texas	397,693	30,000 (a)	427,693	4,293	3,500,000 (a)
Utah	37,012	5,692	42,704	1,115	366,371
Vermont	28,706	2,916	31,622	946	555,384
Virginia	103,000	13,670	116,670	2,233	1,850,000
Washington (g)	154,350	25,864	180,214	4,969	2,828,896
West Virginia (b)	69,862	10,802	80,664	1,659	1,223,448
Wisconsin	277,095	16,205	293,300	8,002	3,127,073
Wyoming	22,926	1,000	23,926	327	267,179
Total	8,234,490	945,826	9,180,316	271,230	99,141,097

(a) Approximate.
(b) For fiscal year ending June 30, 1920.
(c) For registration year ending November 30, 1920.
(d) For the three year period ending December 31, 1920.
(e) Includes 3,560 dealers' licenses.
(f) For first 11 months of registration year ending January 31, 1921.
(g) From March 1 to December 31, 1920.
(h) For 18 months ending December 31, 1920.

It thus appears that there is now one motor vehicle for about every 11 persons. The gain in registrations over 1919 amounts to 2,114,870, which is the greatest increase ever recorded in a single year.

Receipts from registrations and licenses showed a gain of $34,443,842, or 53 per cent over 1919, the greatest increase ever recorded in a single year. The registrations include in a few cases, notably in Maryland and the District of Columbia, duplicate registrations, but these do not materially affect the grand total.

The race for supremacy between New York and Ohio in the number of motor vehicles is again in New York's favor; New York scored 683,919 motor vehicles a Ohio ran second with 620,600 for the entire ye Pennsylvania occupies third place with 570,164 ca Illinois, fourth, 568,914; California, fifth, 568,892; Iow sixth, 437,030; Texas, seventh, 427,693.

In receipts from registrations, New York State lea with $8,817,709. Pennsylvania comes second wi $8,090,873; Iowa, third, $7,487,830; Ohio, fourt $6,400,000; Illinois, fifth, $5,780,612.

A Question of Ethics—

Gratuitous Professional Advice

THE committee on professional practice of the American Institute of Consulting Engineers recently rendered a decision, which has been approved by the council, in the case of a question of ethics involving the extent to which an engineer should give gratuitous advice. The question and the decision are given below:

Statement—A civil engineer specializing in a certain branch of professional work is requested, through an explanatory circular, enclosing a blank form for reply, issued by the official board of an important public enterprise, to express his views as to the design and construction of a proposed public work, in line of his special practice. No retainer or compensation is suggested and obviously none is intended. The request comes from a distant city and relates to an enterprise with which the engineer has no actual present or prospective professional or personal connection. He declined to reply in the manner requested, but called attention to the fact that there are a number of experts in this country capable of giving them sound professional advice.

Questions—(1) Was such a reply warranted and proper from an ethical point of view under the conditions named?

(2) Recognizing that engineers, like the members of other professions, owe to the public as specially qualified good citizens a certain amount of gratuitous advice and assistance in the planning and administration of works and affairs affecting the public welfare, what general principles or rules should guide their conduct in such matters?

Answers—(1) Such a reply was warranted under the circumstances recited.

(2) It is difficult, if not impossible, sharply to define the character or extent of the professional services that the engineer properly may or should contribute to the public without pecuniary compensation therefor. It may vary with conditions and circumstances in each individual case. The patriotic and public spirited citizen will construe his duty in this respect liberally in favor of nation, state, civic organizations and community. Like the members of other professions the engineer is frequently called to serve on public commissions, committees and civic organizations where his specialized knowledge and experience enable him to render services of great public value for which no monetary compensation is provided or expected. Service of this character within proper bounds is to be commended and encouraged.

As a general rule, gratuitous professional service may properly be limited to information, advice and assistance of a general nature relating to the inception, principles involved, or the development of contemplated public enterprises. Specific recommendations, plans, details, specifications and estimates for definite projects, involving professional investigation and study should be regarded as the province of the formally retained and compensated engineer.

These functions are essentially professional in character, and involve special labor and responsibility, which the prudent engineer, acting in his capacity as a citizen only, may not care, and should not be expected or required to assume without the usual professional recognition and compensation. The interests of the profession as well as his own, suggest that his generous impulses be not allowed to great latitude, particularly in cases like the one cited in which he has no public or community interest.

New Ocean Outfall and Screens for Los Angeles Sewage

Slightly Condensed from a Paper by W. T. Knowlton, Engineer of Sewers, Los Angeles, Cal., before the Los Angeles Chapter of the American Association of Engineers, November, 1920.

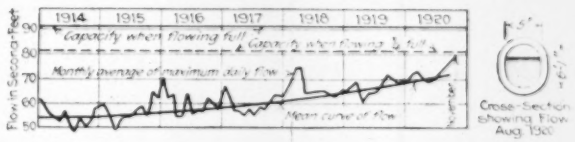
ACCORDING to the recent census, Los Angeles in January, 1920, had a population of 576,673, which is an increase of 81 per cent over its population of 319,198 in 1910. Although this rate of growth may not continue indefinitely, the caring for the increasing population is becoming a problem for the different departments of the city government. The matter of water supply for such a population was wisely provided when the city built its aqueduct which carries water from the Owens River intake 240 miles to Los Angeles.

Present Outfall Sewer — The flow in the main outfall sewer of the city is approaching such a condition that within two or three years it will flow full during even the dry season. During the winter season it has been noted that rain water has found its way into the sewerage system in spite of repeated efforts to prevent its entrance, and has caused the outfall sewer to overflow. The outfall sewer was designed to carry 90 sec.-ft. when flowing full. At the present time the maximum recorded daily flow is about 81 sec.-ft., which fills the sewer for 75 per cent of its vertical diameter. This depth of flow is as much as the sewer should properly carry and leave space for ventilation. It is anticipated that the sewage flow will reach the maximum capacity of the outfall before 1924.

It is considered necessary to submit to popular vote in the near future a bond issue for the construction of a new outfall sewer which would intercept the larger part of the flow in the present outfall sewer, as well as provide for a large area west of the city which it is expected will soon become annexed thereto, and for several residential sections in the westerly portions of the city, which must otherwise depend on cesspools. The proposed new outfall would be laid from a point in the southwesterly part of the city along the lowland to the north and west of the so-called Baldwin Hills and thence southwesterly by tunnel to the Hyperion property of the city on the coast. This would serve all sections lying between Los Angeles and those cities on the west coast which are north of the present outfall sewer, including the Palms and Sawtelle districts, which are at the present time within the city boundaries, and the Sherman, Beverly Hills, and South Hollywood districts, outside of the city, which are rapidly growing. Provision for sewage from Inglewood and those sections to the north and west of Inglewood is also made. Along the west coast the sewage from Santa Monica, Venice and the district adjoining Playa del Rey has been given attention, but it is thought that the sewage of these beach cities can best be cared for by direct treatment within their own limits, or arrangements made for pumping their sewage to the Hyperion site where proper treatment can be given to not only the sewage of greater Los Angeles, but also to that of all the beach cities on the west coast from Santa Monica southerly to and including Redondo.

This proposed north outfall sewer is designed for the removal of sewage from an area of 127 sq.mi., extending from the Los Angeles River westerly to the west coast cities, and from Manchester Ave. northerly to the mountains north of Hollywood. It will have a diameter varying from over 11 ft. to 4 ft., and capacity sufficient for a population of approximately 2,000,000 people. At a point about two miles west of its easterly end, a branch sewer will intercept all sewage coming from that portion of Los Angeles between Jefferson St. and Manchester Ave. and west of the Los Angeles River.

In addition to the proposed north outfall and the branch sewer, it is proposed to construct an intercepting sewer along Slauson Ave., from a point on the westerly boundary of that section of the city which is now sewered, to a point south of the City of Vernon, where the intercepting sewer will turn to the north and be laid along the east side of the Los Angeles River. This East Los Angeles interceptor will discharge its flow into the present outfall sewer at the point where the latter crosses Slauson Ave., and will provide for the removal of all sewage from that part of Los Angeles east of the Los Angeles River. The East Los Angeles sewer is proposed to be laid as far north as the junction of the Los Angeles River and the Arroyo Sec. and so planned that it may later be extended northerly along the Los Angeles River to intercept the sewage from the cities of Glendale and Burbank to the north of Los Angeles, also the Lankershim district. The extension of this intercepting sewer will also provide an outlet for the sewage of the San Fernando valley.



FLOW IN LOS ANGELES OUTFALL SEWER, 1914 TO 1920

The area which would be served by the East Los Angeles interceptor is estimated at 259 sq.mi. The population now tributary to this sewer is estimated at 100,000 but its capacity is designed to provide for a population of approximately 1,000,000 people, which will include the future population of these cities and sections north of the City of Los Angeles.

The plan designed for these proposed sewers provides for the future of Los Angeles as it is estimated to be in 1950. At that time, the population of Los Angeles may be 3,000,000 and the combined capacity of the present outfall sewer and the proposed north outfall sewer is planned for such a future population. In contrast with this plan, it may be noted that the population for which the present outfall sewer was planned did not exceed 750,000. The estimated cost of these new sewers in the preliminary design is $12,850,000, which includes the cost of sewage works at Hyperion. The total length of the proposed sewers is approximately thirty miles.

Sewage Treatment — During the past six years, the constantly increasing amount of sewage discharged into the ocean at the lower end of the present outfall sewer has caused a protest to be made by the residents of the beach cities on the west coast and especially by those of Manhattan Beach, Hermosa Beach and Redondo. The residents of these cities complain that the sewage is washed ashore in the vicinity of the bathing resorts. In the fall of 1915, the city engineer of Los Angeles made plans for sewage works to intercept solid material, and in the spring of 1916 a bond issue for such a plant was submitted to the voters. This bond issue receiving but 44 per cent of the total number of votes cast, another attempt was made in the following year to secure the necessary 67 per cent which was required before bonds could be issued for the installation of a sewage treatment plant at Hyperion. The election in 1917 was no more successful than that of 1916. In the following two years, no attempt was made to present the matter to the voters again on account of war conditions. In the fall of 1919, it was considered that some action should be taken to relieve the undesirable conditions at the Hyperion outfall. The amount of sewage was constantly increasing and injunction suits against the city were threatened. The city engineer, in the budget for 1920, secured appropriations to pay for the right-of-way required for the north outfall sewer.

Earlier plans for sewage treatment had included settling tanks and sludge beds as being best adapted to the conditions at Hyperion. Owing, however, to the increased cost of labor and material, it was thought that other types of treatment could be installed which would cost much less than settling tanks, and the different types of sewage screens were accordingly considered. After investigation it was decided that fine screens of the drum type would prevent the solids and other floating materials from being discharged into the ocean. [The present outfall at Hyperion extends 2,000 ft. from the shore and discharges at a depth of about 20 ft. below mean tide.]

LOCATION OF OLD AND PROPOSED NEW OCEAN OUTFALL AND TREATMENT PLANT, LOS ANGELES SYSTEM

Tests of the ocean water in the vicinity of the different outfall sewers near Los Angeles have shown sufficient oxygen to neutralize to some extent the putrescible matter contained in the screened sewage. Bacterial analyses of the ocean waters at varying distances from the mouth of these outfall sewers indicate that there is also a corresponding reduction in the number of bacteria.

Plans proposed for the treatment of the Hyperion sewage have accordingly included the installation of eight drum screens which will provide for the treatment 60 m.g.d. As the flow increases, other screen units can be installed at an expense which can be met by an appropriation from the yearly budgets, and the cost of such additional units would not be great.

Irrigation—At various times during the past few years, reference has been made by different persons to the use of the Los Angeles sewage, or sewage effluent, after treatment, for irrigation purposes. This method of disposal at first thought seems desirable, but it would require a number of years to properly develop. In contrast with the disposal into the ocean, the disposal on land would require a high degree of purification which would necessarily involve considerable time in selecting the proper type of treatment, lands, and the equipment incidental thereto. Furthermore, the cost of disposal on land would be more at the beginning, even if later this method should be successful.

On account of the nuisance now existing at Hyperion, it is necessary that the sewage discharged into the ocean be screened at the earliest possible date. The beach cities have justly complained of this nuisance, and should relief therefrom not be given within a short time, it is probable that court action against the city of Los Angeles may be instituted. It is accordingly considered that the screening proposed at Hyperion should be installed without waiting to plan for the disposal of the sewage on land.

The opinions above outlined meet with the approval of the sanitary engineering department of the State Board of Health. It is believed by the sanitary engineer of the board that the suspended and floating solids in the sewage are solely responsible for the condition objected to by the beach cities, and screening is accordingly recommended, being less expensive than sedimentation.

The department named also considers that screening plants are less difficult to maintain free from nuisance than are settling tanks as they treat the sewage more quickly and minimize the chance of its becoming stale in the plant. Plans for the disposal of the screenings are being considered which will tend to offset the cost of maintenance.

John A. Griffin is city engineer of Los Angeles.

Industrial Conditions in Soviet Russia

(From Engineering News-Record's Berlin Correspondent)

CONDITIONS in Soviet Russia are an enigma even to her immediate neighbors. Most of what transpires from Russia appears in the shape of rumors and is very contradictory. Fugitives report disastrous conditions, which remind one of countries in the lowest stage of civilization. Soviet emissaries on the other side are eager to spread rosy views. Of Russian newspapers very few find their way abroad, and as they are edited under the strict control of the Bolshevist authorities, their contents are highly flavored. Still they form the only source of news, as verbal reports can rarely be trusted. It seems unnecessary to dig deeper for news because what the Bolshevist newspapers are allowed to print is sufficient to confirm the worst apprehensions of the country's interior conditions. They are chaotic and only a slight pretence of order is maintained. The Bolshevist Government, with surprising energy from the side of the leaders, has made strong efforts to effect improvements, but it is easy to recognize that instead of progress the process of dissolution is continuing.

This view is upheld by a number of German radical leaders who have visited Russia on the invitation of the Bolshevist Government and who have been given an opportunity of contact with a party of some hundred German workmen who had volunteered to work in Russia more than a year ago. These workmen, themselves of decided communistic leanings, have transmitted tales of strongest disappointment and misery. Their enthusiasm and hopefulness have suffered a complete reverse and they are unanimous in the opinion that the country is utterly and hopelessly ruined.

False Rumors of Large Orders

Manufacturers and dealers all over the world will do well to keep these facts in view, especially as rumors have recently been spread of enormous orders for manufactured articles which are said to have been placed in Germany and elsewhere. It is a fact that several emissaries from Russia have visited continental countries and negotiated with manufacturers for the purchase of machines of all descriptions and finished products, some orders having even been given and alluring pictures drawn of further orders to follow. None of these orders, however, has been executed, because they all suffered shipwreck when it came to the point of settling the mode of payment. Russian buyers, when entering into negotiations, always hold out for payment in gold, but when it comes to actual arrangements to be made they have to confess the absolute impossibility of doing so and they propose to pay with raw products, of which they say they have enormous quantities in store, ready to ship.

Manufacturers in continental Europe have, however, become very sceptical toward such tales. A number of German manufacturers, invited to Russia to inspect stores of raw products, came back entirely unconvinced. Such stores of merchandise as Russia could spare for furnishing against foreign purchases are widely scattered over the country, with no possibility to ship to the frontier.

Transportation Paralyzed

Transportation in Russia is even unable to cope with the most stringent requirements of the distribution of food and fuel within the country. Regular goods traffic there is none. The railroads are in a state of decay; fuel and rolling stock are lacking everywhere. Over 80 per cent of existing engines are out of repair and they have lately been put out of commission at the rate of 200 a month. Repairs are carried out in a slip-shod manner, as time is pressing. The same applies to cars. Visitors to Russia are struck with the number of cars out of repair or completely wrecked and clogging the side tracks of the stations. The decay of the road-beds is continually progressing and the railroad bridges are in an appalling condition. As no rails are produced repairs are made by taking rails from side tracks and even from main lines. The mileage of line in service is therefore steadily decreasing. Over 2,000 miles of track have thus been broken up in 1919 for repair purposes. On account of bad fuel and inferior repair of engines the latter cannot produce sufficient steam. Even passenger trains travel at a speed of from 4 to 9 miles per hour.

The Bolshevist Government is fully aware that before an improvement of the country's economic conditions can take place, transportation has to be improved. For this reason they have formed groups of engineering works, mostly engine and car factories, called "advance groups," which receive special attention in the matter of supplies of raw material, fuel and food for the workmen. One of these groups comprises the largest and best developed mills, locomotive and car works, i.e., the locomotive factories in Sormorow, Kolomna and Brjansk, steel mills in Wyksa, and the wagon works in Twer and Moscow. This group of works has been given a specific task to perform in the way of construction of rolling stock.

Reports on the result of this work for the first half year, recently made public, show that the task, although very modest, has not nearly been completed. The works in Sormorow, for instance, were commissioned to produce within 6 months 8 new engines, 30 extensive engine repairs and a specified number of duplicate parts. These works, which employ 8,500 workmen, carried out the following work: New engines, none; repairs, 14; duplicate parts, about 80 per cent of the specified quantity.

The works in Kolomna, employing 4,100 workmen had been given the task of producing in 6 months: 6 new engines, 10 narrow-gage engines and 18 repairs. The result was: One new main line engine, 5 narrow-gage engines and 5 repairs. This factory produced in pre-war times 30 engines a month.

The Moscow wagon works, employing in 1914 2,500 workmen, produced per half year in peace time 1,500 trucks, reserve parts for another 1,200 trucks, 150 new passenger cars, 120 street railway cars and 16 motor cars. The works management reports the output of the last half year as 120 trucks and no passenger cars. Of snow-ploughs, which in pre-war times have been a specialty made in large numbers, the management of these works say that preparations for their manufacture have been completed and "one snow plough is actually in the state of assembling." All manager's reports are unanimous in their opinion that fuel, lack of workmen and their inefficiency are responsible for the poor results. The works in Moscow are furnished only with a poor sort of lignite; pit coal is not obtainable even for these works which have the special attention of the country's rulers. It is significant that it has been impossible to procure for the works mentioned the requisite number of workmen, which was to be 50,000. The actual number of workmen has fallen short of this figure by 18,000. It is said that none of the laborers work full time, the actual working hours having been only 60 per cent of the regulation time. One works manager states that the output per man per working-day equals the output of 1½ hours on the pre-war standards.

The same deplorable conditions prevail in water transport. The complete fleet of barges for petroleum traffic on the Volga consists now of only 190 units, which is insignificant, considering that in pre-war times from 900 to 1,000 of such vessels were constantly moored in the harbor of Nishni-Novgorod.

Fewer Productive Workers

Reports from other manufacturing works show that the diminishing of the number of productive workers in Russia is general. From labor statistics recently published it is seen that in 35 government districts 6,090 factories employing 1,250,000 workmen were running in 1918. In 1920 only 5,800 of these works employing 860,000 workmen were in business. The decrease in the number of workmen was from 26 to 42 per cent in 2 years. The most strenuous efforts of the Bolshevist Government to increase the army of workmen—even the strong compulsion which is exercised—are ineffective. Most of the workmen have hired themselves to peasants, or have become administrative officials, of which there exist now one in six of the population.

It is an open secret that the Bolshevist leaders have long been conscious of the utter failure of their methods. This recognition does not find expression in public, but is proved by certain measures which have been taken lately. One of them is a bill, passed recently, regulating the conditions under which foreign private capital and enterprise is admitted in the country. The object of this bill is stated to be the improvement of the country's production and it creates facilities for foreign business men, individually or organized in companies, in the shape of concessions. Holders of such concessions shall have the right to export part of their production. They shall receive privileges if they introduce new methods which will raise the production.

Such concessions will be given for a long period and the Soviet Government gives a guarantee not to interfere with them in any way, either by nationalization or confiscation. The Soviet Government is trying to give this matter wide publicity in order to attract capital and enterprise from all sides, but continental business men look on the scheme with disfavor. Foreign capitalists and business men lured into embarking in the scheme are believed to take a heavy risk, as the Soviet Government is hardly able to carry out their guarantee, even if they were willing to do so.

Concrete Pile Bridge Fails From Slipping Foundations

Undercutting of New River in Imperial Valley Causes Banks to Move Toward the Middle of River

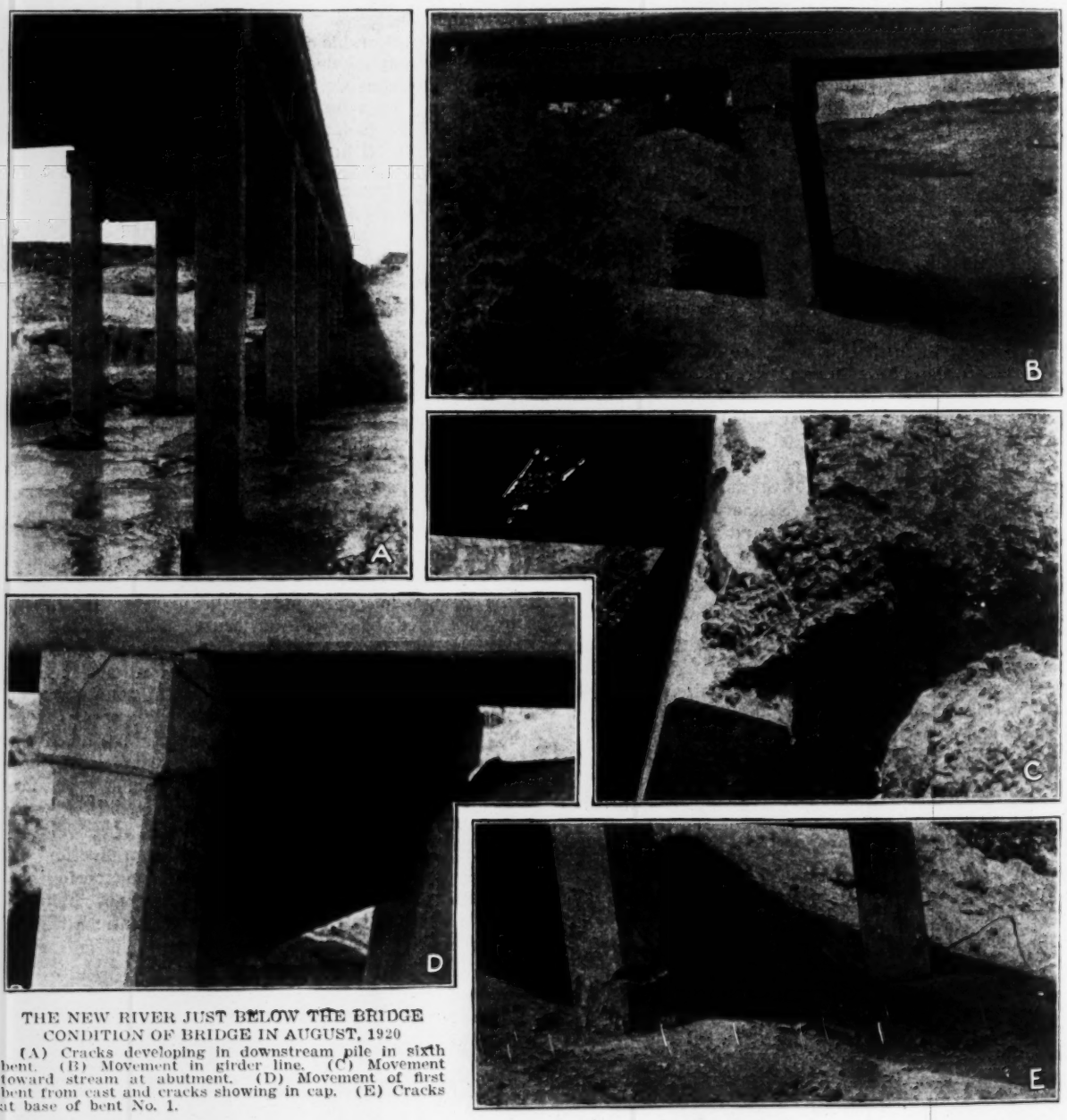
By E. E. East

With Engineering Offices, J. B. Lippincott, Los Angeles, Cal.

GENERAL slipping of the banks toward the middle of the stream, due to the deepening of the channel of an undercutting stream, has resulted in the failure of a reinforced-concrete trestle across New River in the Imperial Valley in southern California. The failure has been progressive and has now become so great as to make doubtful the possibility of saving the structure.

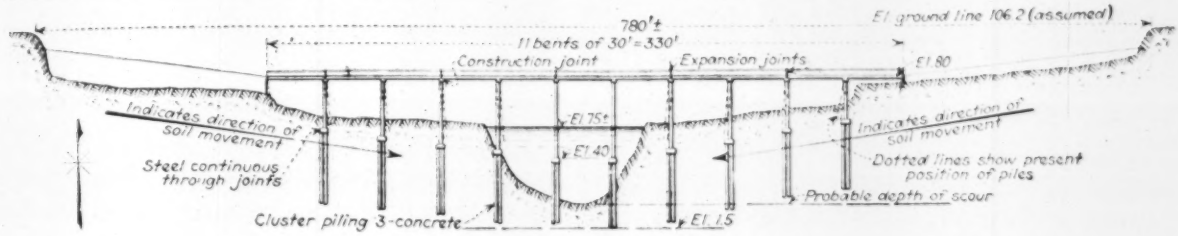
The channel of New River was cut during the overflow of the Colorado in 1905 and 1906. During the early stages of the flood the water spread out over a strip of ground approximately six miles wide and extending from the Mexican border to the Salton Sea. Through the efforts of various interests in the valley, in an attempt to save this territory from the erosive action of the flood, the river was finally confined to a channel of some 700 or 800 ft. in width, where it soon cut to a depth of 30 to 40 ft. below the natural ground level. With the closing of the break in the Colorado and the recession of the water the river gradually confined itself to the center of this gorge, where at the present writing it has cut its way through the loose loam soil to a total depth of approximately 60 ft. below the original ground line at the bridge location. A view herewith shows the present condition of the river.

The bridge was built in 1918 by Imperial County, on the line of the State highway from San Diego to



THE NEW RIVER JUST BELOW THE BRIDGE
CONDITION OF BRIDGE IN AUGUST, 1920

(A) Cracks developing in downstream pile in sixth bent. (B) Movement in girder line. (C) Movement toward stream at abutment. (D) Movement of first bent from east and cracks showing in cap. (E) Cracks at base of bent No. 1.



REINFORCED-CONCRETE TRESTLE OVER NEW RIVER IN IMPERIAL VALLEY, SHOWING MOVEMENT OF BENTS

Imperial Valley, and spans the second and present channel of the river. It is of the reinforced-concrete trestle type, containing 11 bents of 30 ft. span, or a total length of 330 ft. Three of the eleven bents are in the present stream channel.

Using an assumed datum of El. 100 the bridge floor is at El. 80. Reinforced-concrete piles were driven in two clusters at each bent to El. 1.5 for the central bents, the penetration being slightly decreased toward the abutments, and a concrete cap poured over them at El. 40 for central bents and stepped up, as shown in the sketch, to the abutments. On these caps the two posts for the superstructure were cast in place. Both footing and posts were tied by reinforcement into the caps.

THE NEW RIVER JUST BELOW THE BRIDGE

The piles for the bridge were driven with great difficulty, water jets being used in all of them. No change in the character of the ground was indicated for the depth to which the piles were driven. In fact, wells driven in the vicinity indicate a silt loam for a depth of several hundred feet.

About the beginning of last year (1920) employees of the State Highway Commission noted that the center of the bridge was apparently moving downstream. This movement was slight but sufficient to be noted by the eye, without the aid of instruments. Upon examination it was found that small cracks were developing in the abutments and posts at the end bents near the ground line and between the caps and the girders.

The writer had occasion to inspect the bridge in August, 1920, and found that the conditions had become more serious. A more recent inspection shows that the movement is continuing. The views herewith indicate the condition last August.

As shown in view *C*, the abutments have moved in toward the middle of the stream, the movement in each case being greater at the ground line than at the girder line. Bent No. 1 from the west end (view *E*) shows a horizontal movement of approximately 10 in. in a vertical height of 12 ft. The upstream post in this bent has broken about 1 ft. above the cap, while the downstream post has broken at the cap line. A vertical movement along the expansion joint in the girders and floor of about 1 in. was noted, as shown in view *B*. View *D* shows the movement of the first bent from the east end of the bridge and cracks developing in the cap there. View *A* shows cracks developing in the downstream post in the sixth bent. The fill approaches to the bridge and the concrete pavement at points on either side where the road leaves the cuts have settled in each case 12 in. or more. No settlement was noted at the abutments, although view *C* shows a movement of the fill as evidenced by cracks.

From the character of the failure noted, it would appear that there is a movement of the ground from the extreme banks of the channel on each side toward the middle of the stream, this movement being permitted through the release of pressure due to the cutting of the river. This movement may have been assisted by the numerous earthquakes which have occurred in the valley during the past year.

Properties of Various Hickories Compared

The chief difference between true and pecan hickory, as shown by tests at the Forest Products Laboratory, is in toughness or shock-resisting ability, the property which is so valuable in wood handles and vehicle parts. In this property true hickories are far superior to the pecans. The strength of pecan is somewhat higher than that of oak or maple, and for such articles as handles and buggy spokes carefully selected pecan is probably to be preferred to either of these two woods. In heavy wagon parts, such as axles, spokes and felloes, maple and oak are reputed to stay in place better than hickory. Except in case of extreme shortage of maple, true hickory and oak, it would probably be inexpedient to use pecan hickory for these heavy parts. The sapwood or white wood of hickory, which is usually preferred by the trade, is the better wood in young, thrifty trees, but in over-mature trees it is inferior to the heartwood. A red color does not necessarily make sound hickory suitable for vehicle stock. A more useful criterion than color is the proportion of summerwood, or non-porous wood, in the annual growth rings. In hickory stock intended for the more exacting uses, the non-porous wood should form at least one-half and preferably three-quarters of the annual ring. The remaining part should contain very few pores. A further precaution to be observed is that the non-porous part of the annual ring should be hard and flinty. The best criterion of the strength properties of either true or pecan hickory is the weight of the dry wood. This weight should not be more than 10 per cent below the average for true hickory, or not less than 45 lb. per cu.ft. of oven-dry wood.

Some Unsettled Points in Structural Design

Engineering Judgment Applied to a Dozen Open Questions on Columns, Beams, Grillages, Crane Girders and Rivets

By R. Fleming
American Bridge Co., New York City

QUESTIONS often present themselves in the design of steel structures on which the designer does not find adequate help in textbooks. A few of these points are considered in the present article, which, however, does not attempt to *settle* anything but simply records the writer's views and practice.

Mill-building columns with brackets carrying crane girders or other loads and columns with knee braces usually present in their design two puzzling questions: Shall bending moments be determined with the ends considered fixed or hinged? and, how shall the direct or axial stress and the bending stress be combined in proportioning the column?

Bending Moments in Columns with Brackets

The first question is not one of pure mathematics but depends for its answer upon the physical condition of the ends and the anchor bolts. Ordinary set anchor bolts but partially fix the base. The point of contraflexure is probably at one-fourth to one-third the distance from the base to the bottom of the bracket or knee brace. Connections of roof trusses to columns are never strictly rigid, although with proper details the error in assuming them to be so is slight.

In consideration of these factors, the writer finds the bending moment by first assuming the ends of the column to be hinged, equating the vertical and horizontal couples and solving for the horizontal reaction at the base. This reaction multiplied by the distance to the bottom of the bracket or knee brace determines the bending moment at that point. Because the ends of the columns are partially fixed, eight-tenths (sometimes seven-tenths) of the bending moment thus found is used in the fundamental formula for flexure $S = Mc/I$ to determine the extreme fiber stress. (It may be noted that the Rankine method for eccentric loads as given in various editions of the Carnegie "Pocket Companion" does not apply to a load resting on a bracket between the ends of a column and applied several inches from the column face.)

Proportioning a Column for Eccentricity

As to the second question: Many bridge specifications, among them those of the American Railway Engineering Association, call for members subject to both axial and bending stresses to be proportioned so that the combined fiber stress will not exceed the permissible axial stress.

The Canadian Engineering Standards Association specifications for steel railway bridges (Sept., 1920) contain the significant paragraph:

> Members subject to both axial and bending stresses shall be proportioned so that the combined fiber-stress will not exceed the allowed axial unit-stress; except such members as may be subject to bending moments from their own weight or from eccentricity, when the total fiber-stress shall not exceed the allowed axial unit-stress more than 10 per cent; but in no case shall the section be less than that required for the axial stress alone.

Bishop, in his "Structural Drafting," 1920, writing of members which resist bending and direct stress says:

> In a compression member the allowed unit stress is usually a function of the least radius of gyration. Opinions differ as to whether the least radius of gyration about *either* axis of symmetry or the least radius of gyration about an axis *perpendicular* to the plane of bending should be used. The use of the former is often specified, particularly for bridges, but the resulting margin of safety is unnecessarily large where the direct stress is relatively small. It is better to consider two different allowed unit stresses in compression as explained below. This method of design has been used extensively in building work by engineers of repute with apparent satisfaction. (1) The unit stress which is determined by the least radius of gyration about an axis *perpendicular* to the direction of bending should not be exceeded by the sum of the unit stress in direct compression and the unit stress due to bending. (2) The unit stress which is determined by the least radius of gyration of the *whole* member should not be exceeded by the unit stress in direct compression *alone*. If the radius of gyration used in (1) is also the least radius of the whole member, step (2) is unnecessary.

The side columns of buildings are usually stayed in the direction having the least radius of gyration by the walls or siding. The greatest bending stress from a bracket or knee brace is at the point of maximum bend-moment and varies to zero at the points of contraflexure. The axial stress from the load that causes bending is carried by that portion of the column below its point of application. Since neither the maximum bending stress nor the entire axial stress extends the whole length of the column the writer in proportioning side columns (Case 1 of Bishop) usually increases the allowable working stress 20 per cent, provided the section thus obtained is not less than that required for bending or axial stress alone. For interior columns with brackets or knee braces, and unstayed in both directions, the writer follows Bishop, i.e., does not use the 20 per cent stress allowance just noted.

Beams and Girders Unsupported Laterally

In an article, "Beams Without Lateral Support" (*Engineering News*, April 6, 1916, p. 648) the writer pointed out the wide variation of published rules for the strength of beams unsupported laterally. This variation is still found. For instance, the Carnegie "Pocket Companion," edition of 1920, for an unbraced beam of a span 40 times the flange width allows 43.8 per cent of the stress that would be permitted if the compression flange were secured against lateral deflection, while "Cambria Steel," edition of 1919. allows 73 per cent for the same beam.

The American Railway Engineering Association's 1920 specifications for steel railway bridges limit the stress per square inch in the compression flanges of plate girders to $14000 - 200\,l/b$ in which l is the length of the unsupported flange and b is the flange width. Ketchum, in "The Design of Highway Bridges," 1920, specifies $16000 - 150\,l/b$ for beams and girders. The specifications of the South Carolina highway department, 1919, prescribe $20{,}200 - 350\,l/b$ when the unstayed length l exceeds $12b$, and limits l/b to 40. The Boston building law of 1919 gives $19200 - 160\,l/b$ for for l/b greater than 20. The 1920 Chicago law gives $20000 - 160\,l/b$ for ratios over 25.

Since the bending stress in a beam due to direct load varies from a maximum to zero, it seems needlessly severe to assume the compression flange to be a column loaded the whole length with the maximum bending

stress. The problem is to find an equivalent length of column with equivalent loading. Several attempts have been made to do this.

Box, in his "Strength of Materials" (first edition 1883) concludes that the maximum tendency to deflect laterally is represented by considering the compression flange as a column of a length equal to two-thirds of the length of the span and carrying a load equal to one-third the greatest compressive stress at any point.

Prof. H. F. Moore, in "The Strength of I-beams in Flexure" (*Bulletin 68*, University of Illinois Engineering Experiment Station, 1913) concludes that the computed *ultimate* flange stress for steel I-beams not restrained against sidewise buckling is given by the formula: $40000 - 60\ ml/r'$ in which l is the length of span in inches, r' is the radius of gyration of the I-section about a gravity axis *parallel* to the web, and m a constant ranging from 0.25 for a fixed-ended beam with load at the mid-point to 1.0 for a cantilever beam uniformly loaded. For a simple beam with load at mid-point m is given equal to 0.50 and for the same beam uniformly loaded m equals 0.67.

It is readily seen that both the Box and the Moore methods allow much greater extreme fiber stress than any of the specifications quoted.

The present writer uses the following unit bending stresses when the compression flange is unstayed laterally: For I-beams deeper than 10 in., and for plate girders without cover plates, $19000 - 250\ l\ b$; for I-beams 10 in. deep and under, and for plate girders with cover plates, $19000 - 225\ l\ b$. When the compression flanges of beams and girders are rigidly held at the ends, he takes the unsupported length l as three-fourths of distance center to center of end connections.

Crossed Diagonals As Struts

Some ten years ago the writer designed several hundred towers of a power transmission line. The towers were four-sided, each side being double-latticed with horizontal struts at the panel points. The web system was calculated as two Warren trusses, the angle diagonals of the two systems being bolted together at their mid-points. The tower legs were inclined, thus taking most of the shearing stress due to the wind and making the stresses in the diagonals quite small. The question at once came up as to what unsupported length, l, should be used in the negative, or reduction, term of the column formula. From some tests made with paper models it was deemed legitimate to assume for l the distance from center of end bolt hole to bolt hole at intersection. For the small stresses $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{4}$-in. angles (galvanized) were used. No buckling of any of these light angles has ever been reported. For heavier angles, say $\frac{1}{2}$ or $\frac{5}{8}$-in. thick, and corresponding stresses, with a single bolt at their intersection, the unsupported length would have been taken as three-fourths of the distance between centers of end connections, as the writer would consider the restraining effect of the tension diagonal to be less in this case.

Similarly in double latticing of flat bars riveted at intersections, the writer assumes the unsupported length l in the negative term of the compression formula to be three-fourths the distance between centers of end rivets. This is approved, by implication, by the many bridge specifications that require the thickness of bars in single lattice to be not less than one-fortieth the distance between end rivets while one-sixtieth is allowed for bars in double lattice if riveted at intersections.

Shall grillage beams be proportioned on the assumption that the maximum bending moment is at the center or at the edge of the superimposed load? A few years ago textbooks and handbooks were about equally divided between the two methods but at present the first method is in the lead; half a dozen rolling mill handbooks use it.

There is room for doubt. As a beam becomes loaded the point about which it tends to turn shifts from the center toward the edge of the superimposed load; on the other hand the edge of any wall column base or beam is seldom strong enough to take the uplift from the projecting portion of the beams below, and its yielding shifts the fulcrum back toward the center. The truth therefore is apt to lie between the two methods, and the writer has accordingly adopted the following practice:

For foundations with but one tier of beams, bending moments are calculated about the center of the superimposed load and 16,000 lb. per sq.in. is used for extreme fiber stress in bending. For foundations with two or more layers of beams embedded in concrete, bending moments are taken about the center of the superimposed load and 20,000 lb. per sq.in. is used for both layers. Under specifications allowing but 16,000 lb. fiber stress, the point of maximum bending moment is assumed midway between the center and the edge of the superimposed load.

Crane Girders and Coal Bunkers

Crane impact has not been measured, but the prudent designer is bound to allow for it. In view of the infrequency and lack of harmony of specification requirements, the writer takes the impact due to electric traveling cranes at 25 per cent and that due to hand-power traveling cranes at 10 per cent. No impact is considered for two cranes in action on the same girder.

In addition to vertical loads the top flanges of crane girders are designed to resist a total transverse horizontal thrust of 20 per cent of the lifting capacity of the crane, or 10 per cent at each end of the crane, divided equally among the wheels of the end truck.

Coal bunkers are assumed to be surcharged when it is possible for them to be so loaded. The weight of loose coal is usually taken at 56 lb. per cu.ft. for anthracite and 50 lb. for bituminous; the angle of repose 30 deg. for anthracite and 35 deg. for bituminous. The writer has found that for bunkers up to 20 ft. in depth the hydrostatic pressure of 25 lb. per cu.ft. is ample for lateral pressure; this assumption usually allows for sufficient surcharge. Of course, the bottom of the bunker is designed for actual weight of coal contained.

Miscellaneous Points

In determining column loads no reduction of floor area is made for stair openings, unless the area of opening is one-third or more of the area of the floor panel.

Column formula commonly used: $S = 16{,}000 - 70\ l/r$ with a maximum value of $S = 13000$.

Tension in rivets is assumed at 7,000 lb. per sq.in. Tension in field bolts (not anchor bolts) is assumed at 9,000 lb. per sq.in. net section.

Shear and bearing values of countersunk rivets are assumed at three-fourths the values of rivets with full heads when the metal is not thinner than one-half the diameter of the rivet. As a rule countersunk rivets are not used in thinner metal, but when unavoidable they are rated at three-eighths the values of full-headed rivets. Flattened heads are assumed equal to full heads

when their height is not less than three-eighths inch, or one-half the diameter of the rivet for ⅞-in. rivets and less. Rivets flattened to less than these heights are regarded as countersunk rivets.

Bearing value on plate-girder stiffeners transmitting loads is assumed at 24,000 lb. per sq.in. of metal, excluding the area of the chamfered portions over fillets of flange angles. Stiffeners transmitting loads are designed as columns of length equal to one-half the depth of the girder.

Highway Traffic Committee Urges Advance Planning

Answers to Questionnaire Indicate Need for Standardization of Traffic Census Methods and Results

BASED on a questionnaire to which 52 replies were received from 23 state highway departments, 21 counties in seven states, 5 cities in four states and 3 commercial organizations, a final report on present and future traffic conditions was submitted to the annual meeting of the New Jersey State Association of County Engineers, at Trenton, Jan. 25, by a committee consisting of J. L. Bauer, chairman, J. J. Albertson, J. M. Abbot, F. A. Reimer and H. F. Harris. The committee, which was appointed in 1919, presented a summary of the replies to its questions and also made recommendations governing future traffic studies, emphasizing particularly the need for a standardization of traffic census work so that results on different roads in different parts of the country may be intelligently compared. A summary of the report follows:

Results of Questionnaire

The results of the questionnaire indicated that for purposes of road classification the terms "heavy" and "light" were preferred to "commercial" and "pleasure" for designating the character of traffic. Opinion was evenly divided as to whether such a classification should be based on maximum or on average traffic. It was indicated that a 2½-ton vehicle should be the dividing line between "heavy" and "light" traffic.

Thirty-three answers showed that no traffic records were available, while fourteen of those who had traffic records indicated that they were in most cases not dependable. Such records as have been taken, however, show that truck traffic has been increasing on country roads at a faster rate than other automobile traffic.

Replies to questions regarding roadway widths varied widely. Paved portions of existing roadways ranged from 9 to 60 ft.; forty-eight replies indicated general widths of 16 to 20 ft., thirty-six named 18-ft. widths and twenty-five named 16 ft. Widths between gutters were shown to range from 20 to 60 ft., 32 ft. being the average width of all mentioned. Total roadway widths were from 20 to 120 ft., with 60 ft. as the average and 50 ft. as the width most generally in use.

The probable increase in automobile traffic in the next 10 years will be somewhere between 30 and 500 per cent, according to the replies received. Fifteen replies stated that the future yearly increase will be greater than the yearly increase in the past; twelve believe that such yearly increase will be equal to that of the past; while eleven are of the opinion that the future will bring about a reduced rate of increase. There was, however, practically unanimous agreement that commercial traffic on country roads would increase faster than other traffic and that total loadings would show an increase.

Road traffic, the committee pointed out in one of its questions, has doubled in some sections in periods of from two to three years. Assuming road traffic 6 years hence to be four times as great as it is at present, a query was raised as to whether present roads could accommodate the increase. Thirty replies answered in the negative and fifteen in the affirmative.

Practically all replies showed a desire to eliminate railroad grade crossings and to increase paved widths of roadway and rights-of-way. Twenty-two replies approved the suggestion made by the committee of planning parallel roads on main routes so as to provide for one-way traffic roads or for a division between commercial and pleasure traffic. Many localities are studying this question.

Commenting on the growth of the automobile industry, the report states that in 1919 there were more than 7,500,000 motor vehicles in the United States; the gain in registration in 1919 over 1918 was about 25 per cent. Assuming the production of motor vehicles to increase in the future at the same rate as in the past the passenger car production in 1930, according to the report, will be 3,400,000 vehicles and motor-truck production 1,340,000 vehicles. At present in the United States there is one automobile for each 14.14 inhabitants. In France the proportion is one automobile to 198 persons, while in Great Britain it is one automobile to 180 persons. The State of Iowa claims one automobile for each six persons.

The report indicates that within a few years it is reasonable to expect that with the aid of the United States Government a sum approximating $1,000,000,000 per year will be spent on highways.

Traffic Data

Information received by the committee in reply to the questionnaire, covering traffic data in various parts of the United States, is summarized below:

On the Lincoln Highway in Pennsylvania between Philadelphia and Trenton it is estimated that in the year 1918 the total traffic of teams, automobiles and trucks was 225,000.

In the County of Los Angeles, Cal., in various months in 1919 and on eight different roads the traffic ran from 2,000 in 24 hr. up to 7,200 in 24 hr., the count being made on four classes of traffic, horse, motorcycle, automobile and motor truck. The estimated tonnage was from 3,064 tons in the first case to 8,832 tons in the second.

At the city line of the city of Seattle, Wash., at South Park in July, 1919, the total daily traffic ran from 700 to 2,070, counting about 8 hr. per day.

In Allegheny County, Pa., in various months during 1919, counts were made on twenty-three roads for a period of seven days each and for 12 hr. each day. The total counts for the seven days on each road ran from 1,579 vehicles to 15,442 vehicles.

In Union County, N. J., the traffic census made on four successive Saturdays and Sundays in the early summer of 1918 at four of the densest traffic roads in the county showed a total traffic census for 24 hr., taking the average of days of observance, at from 4,500 to 12,000 vehicles. Two of these points registered very close to the figure 12,000 vehicles in 24 hr.

Daily traffic for the new Hudson River vehicular tunnels between New York and Jersey City, as forecast by the Tunnel Commission, will be as follows:

1924—date of opening of tunnel, 16,500 vehicles daily.
1929—25,900 vehicles daily.
1934—37,800 vehicles daily.

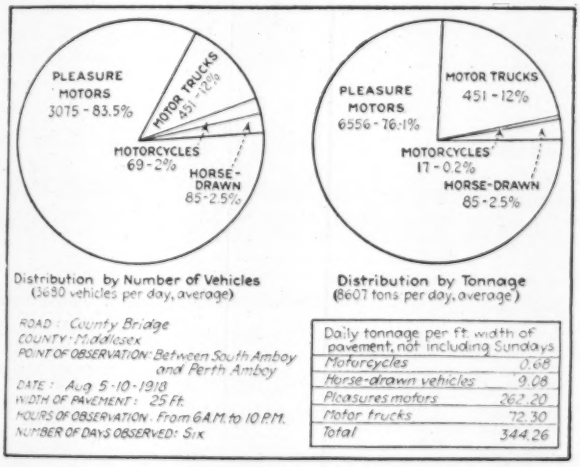
The amount and increase of traffic over four New York City bridges over the East River in a period of seven years is given below:

	1912 Daily	1919 Daily	Per Cent Increase
Brooklyn Bridge	4,000	6,700	67
Manhattan Bridge	4,800	21,400	345
Williamsburg Bridge	6,000	16,300	172
Queensborough Bridge	3,500	18,700	435

UNIFORMITY NEEDED

The report points out there is apparently no basis of understanding throughout the country as to the terminology of traffic. Traffic information is obtained in different ways and for different periods of time, so that with the data available comparisons cannot well be made. The committee believes that traffic could be divided by units of 100 vehicles per day and roads then numbered from one up, traffic No. 1 covering 100 vehicles per 24 hr., traffic No. 8, 800 vehicles per 24 hr., etc.

The committee recommends greater extension of traffic census work, extension of research work, planning,


PLEASURE MOTORS 3075 - 83.5%
MOTOR TRUCKS 451 - 12%
MOTORCYCLES 69 - 2%
HORSE-DRAWN 85 - 2.5%
Distribution by Number of Vehicles (3680 vehicles per day, average)
PLEASURE MOTORS 6556 - 76.1%
MOTOR TRUCKS 451 - 12%
MOTORCYCLES 17 - 0.2%
HORSE-DRAWN 85 - 2.5%
Distribution by Tonnage (8607 tons per day, average)
ROAD: County Bridge
COUNTY: Middlesex
POINT OF OBSERVATION: Between South Amboy and Perth Amboy
DATE: Aug. 5-10-1918
WIDTH OF PAVEMENT: 25 Ft.
HOURS OF OBSERVATION: From 6 A.M. to 10 P.M.
NUMBER OF DAYS OBSERVED: Six
Daily tonnage per ft. width of pavement, not including Sundays
Motorcycles 0.68
Horse-drawn vehicles 9.08
Pleasures motors 262.20
Motor trucks 72.30
Total 344.26

SPECIMEN CHART SHOWING TONNAGE DISTRIBUTION

now, for future state or county highway systems and extensions thereof, and the planning of present construction with a view to traffic in the immediate future. It is realized also that the methods of taking the traffic census must be standardized. Reproduced herewith from the report is a sample of a traffic census sheet following that used in one of the eastern states which the committee believes to be suitable for general use. With this sheet the totals of any class of traffic and the grand total of all traffic are obtainable; the loads passing over the roadway in proportion to the width thereof may also be determined. The specimen sheet herewith is somewhat condensed in space; actually more room would be provided for the census figures.

The report also submitted a sample method of charting traffic, as shown herewith.

Replies to the questionnaire indicate that the normal maximum or average maximum traffic should be taken as the basis of traffic for the roads. In northern climates the periods for taking traffic censuses could be selected as follows:

	Month	Days of Observation
First period	April, May, June	3 consecutive days, including Sunday
Second period	July	3 consecutive days, including Sunday
Third period	August	3 consecutive days, including Sunday
Fourth period	September, October	3 consecutive days, including Sunday

— SUGGESTED FORM OF TRAFFIC CENSUS SHEET

Traffic Census Sheet County No. ..... Station No. ..... County .....
State Highway Department of New Jersey 192
Road at .....
Exact location .....
Count taken ..... from ..... to ..... from ..... To .....

Time Count Was Taken	Motorcycles	Light Horse: Empty	Light Horse: Loaded	Heavy Horse: Empty	Heavy Horse: Loaded	Pleasure Motor Cars: Light	Pleasure Motor Cars: Heavy	Light Motor Trucks: Empty	Light Motor Trucks: Loaded	Heavy Motor Trucks: Empty	Heavy Motor Trucks: Loaded	Specials: 10-Tons	Specials: 15-Tons	Specials: Over 15-Tons	Street Cars	Hourly Totals
6 a.m. to 7 a.m.																
7 a.m. to 8 a.m.																
8 a.m. to 9 a.m.																
9 a.m. to 10 a.m.																
10 a.m. to 11 a.m.																
11 a.m. to 12 N.																
12 N. to 1 p.m.																
1 p.m. to 2 p.m.																
2 p.m. to 3 p.m.																
3 p.m. to 4 p.m.																
4 p.m. to 5 p.m.																
5 p.m. to 6 p.m.																
6 p.m. to 7 p.m.																
7 p.m. to 8 p.m.																
8 p.m. to 9 p.m.																
9 p.m. to 10 p.m.																
10 p.m. to 11 p.m.																
11 p.m. to 12 m.																
12 m. to 1 a.m.																
1 a.m. to 2 a.m.																
2 a.m. to 3 a.m.																
3 a.m. to 4 a.m.																
4 a.m. to 5 a.m.																
5 a.m. to 6 a.m.																

Total roadway—
Of the above motor vehicles ..... carried foreign licenses as follows: .....
Weather .....
Type of pavement ..... Condition of pavement .....
Width of roadway ..... Width of pavement ..... Traffic ..... Narrow tires ..... Special .....
Inspector .....
Notes ..... Checked by .....

Space below this line reserved for office use.

Kind of Vehicle	No. of Vehicles	Weight, Tons
Motorcycles		0 25
Light horse, empty		1 25
Light horse, loaded		2 00
Heavy, 2-horse, empty		3 20
Heavy 2-horse, loaded		6 20
Light pleasure motor		1 50
Heavy pleasure motor		2 50
Light motor truck, empty		1 00
Light motor truck, loaded		2 50
Heavy motor truck, empty		5 00
Heavy motor truck, loaded		10 50
Specials		
Specials, 10-tons		
Specials, 15-tons		
Specials, over 15-tons		
Totals		

Filed Sheet No. ..... County .....
Tonnage per ft. width of pavement .....
Tonnage per ft. width of roadway .....
Includes weight of horses.
Motorcycles ..... Tons
Light horse, empty ..... Tons
Light horse, loaded ..... Tons
Heavy horse, empty ..... Tons
Light pleasure ..... Tons
Heavy pleasure ..... Tons
Light motor truck, empty ..... Tons
Light motor truck, loaded ..... Tons
Heavy motor truck, empty ..... Tons
Heavy motor truck, loaded ..... Tons

Calculations by ..... Filed by ..... Date filed .....

The traffic census should cover the entire 24 hr. in each case. In many instances, however, the traffic during a part of the total day might easily be approximated and expense thus saved.

It is recommended that state highway departments and county highway departments prepare maps showing present and future highway systems and extensions thereof. The planning should extend to a period, say 20 years ahead, along broad lines in a manner somewhat similar to that now in use in many places in city planning.

New roads should be built of generous width, not less than 60 ft., with particular attention to the securing of curves of large radius and the avoidance of steep grades and railroad grade crossings. This plan of future roads could be altered from time to time as necessity arose, but should always be kept many years in advance of present-day needs.

Considerable work could be done at this time, the report states, which would be of great future benefit if, in planning construction, special attention were given to wide right-of-way widths, flat curves and easy grades. These points are among the most permanent of present considerations, as they would, no doubt, outlast the present actual road constructions. Likewise, in the design of bridges, if of a permanent character, such as steel, stone and concrete, the idea could be kept in mind of their use by a traffic, say 10 or 20 years in advance of the present date. This consideration might lead to the building of wider and stronger structures.

In conclusion, the committee believes that the requirements of the future along road-building lines cannot now be fully determined, but by the use of present knowledge, the securing of additional necessary data and the estimating of future traffic, much may now be done by road builders which will not only be of present value, but which will be of greater value in the immediate and more distant future.

Federal Aid for Drainage Proposed

Government assistance in the drainage of swamp lands, protection of overflowed lands and reforesting of cut-over lands is provided in a bill now before Congress, drafted by Edgar A. Rossiter, consulting engineer, Chicago. Such assistance would be rendered through the Department of the Interior, with a fund provided by annual appropriations by Congress. Under the proposed plan any state reclamation board could call for an investigation of a project to determine such charge per acre on the lands affected as would return to the fund the estimated cost of construction, the board to have charge of construction. For operation and maintenance an additional charge might be made, but this work might be transferred by the Department of the Interior to a local drainage association or district. When any project includes a navigable stream which might be utilized for barge transportation the cost would be divided between the Federal government and the landowners. Mr. Rossiter points out that Illinois alone has 10,000,000 acres of swamp and overflowed lands, but that State laws provide no relief, while the Federal reclamation act establishes a precedent for such improvement work as is covered in the proposed bill. He states that arid lands are worth $50 to $100 per acre when irrigated but that swamp lands are worth $200 to $350 per acre when drained.

Criticism of California Highways Policy Answered

State Commission Issues Reply to Joint Report of Auto Club's Engineering Advisers

IN REPLY to a joint report on California's highway system made recently in behalf of two local automobile associations (see *Engineering News-Record* Feb. 3, p. 207) the state highway commission has issued a statement in defense of its policies from which the following extracts are taken:

Two major criticisms are made of the policies under which California has developed its highway system: One has to do with the type of roads constructed—particularly their width and thickness. The second deals with the plan under which it is proposed to expend moneys remaining in the $40,000,000 bond issue.

The first criticism involves the question whether state highways should be built upon the unit plan and widened, thickened, and surfaced as traffic increases, or whether the ultimate road, if such a thing exists, should be built as the first and original construction. If the latter plan is adopted, it marks a complete departure from the policy under which California has developed a highway system that touches and serves almost every part of the state. If the plan that the two auto clubs now advocate had been adopted, highway construction in California would today be practically confined to the construction of a boulevard between a few large cities.

Against this policy is that of the commission for the construction of a road of sufficient width and thickness to take care of existing traffic, with reasonable regard for traffic growth. It provides for widening and thickening as traffic demands a heavier duty road, without the loss of the original investment.

On this point the biennial report of the highway commission says: "This policy has resulted in giving to California a mileage in improved highways that could never have been built had roads been originally constructed to meet traffic demands of the far future. Not only has this added mileage justified the commission's construction policy, but it is further justified by the fact that the alternative policy of building completed roads would have cost the state millions of dollars without due return."

It would be interesting to know just how the fact will be determined as to just what future traffic is to be, and what thickness and width of road it will be necessary to build to take care of such traffic. To quote from the report of the auto clubs: "The number of automobiles in California has increased from 98,399 in 1913 to 535,000 in 1920. In the same interval trucks have increased from 5,299 to 35,000." Continuing the report says: "We may confidently expect a great increase in the number of trucks. Their size, weight and future speed is an uncertain question."

The fact that the state highway system is taking care of this enormous expansion of traffic indicates the substantial character of its construction, and that the roads were planned both with foresight and judgment.

So much for past construction policies. The highway commission agrees with the auto clubs that the time has come when traffic demands a heavier duty truck highway. Recognizing this, the commission, before any question of the sufficiency of the highways was raised, had already substanially increased its specifications. Much of its biennial report submitted in January is devoted to recommendations for widening, thickening and surfacing the older highways and for obtaining funds for this improvement through the medium of a gasoline tax.

The commission contends that this heavier duty highway can be secured without the loss of any appreciable part of that portion of the $36,000,000 that California has invested in its paved roads if a continuous program of widening and thickening is carried on well in advance of permanent injury to the highway through intensive traffic.

As to future construction, the auto clubs suggest a road from 6 to 8 in. in thickness, reinforced, of a minimum width of 20 ft. and 24 ft. wide near the large cities. The specifications of the commission call for a 5-in. reinforced road, of a minimum width of 15 ft., but built wider where present traffic or the outlook for early traffic development demands a wider highway; and with the road designed so that it can be widened and thickened to meet future traffic demands.

The commission is not averse to increasing its minimum specifications. But the people of the state must understand that the construction of wider and thicker highways will cut enormously into mileage, just as the increase in specifications from a 4-in. reinforced slab to a 5-in. reinforced slab has cut into mileage.

Relative to the second major criticism, the $40,000,000 bond issue was made up by budgeting amounts to certain roads. The commission stands by the budget. It proposes to spend on every road as much as is in the budget for it. It does not propose to rob one road to build another. The auto clubs practicaly propose to abandon the budget and to such an extent as may be necessary to throw the new roads overboard.

The commission has adopted as its standard of construction a cement concrete base or slab built to meet traffic necessities. As funds are made available, this slab should be widened, thickened and finished with a wearing surface. Such a road, the commission believes, is the most practicable highway, both as regards the ability of the state to construct and as regards the service to be obtained from the road. The commission is not convinced, as the auto clubs appear to be, that the concrete road without a wearing surface is the final word in pavement design.

Proposed Grouping of Railways in Great Britain

Government Plans Seven Groups—Companies Prefer Five—Controversy Over Basis of Rates and Financial Returns

COMBINING the railway systems of Great Britain into a few large groups is proposed by the British government and a bill for this purpose has been prepared by the Minister of War. Certain features of the bill do not meet the approval of the railways, which have presented their views to the minister through the Railway Companies Association, in the hope of effecting a settlement which will protect the interests of the companies and their shareholders, and will avoid excessively high rates or the continuation of subsidies at the expense of the taxpayers, but will place the railways on the sound financial basis necessary for their efficient operation.

Under the government plan, there would be six groups for England and Wales and one for Scotland, but the Minister of War has expressed some doubt as to whether the passenger and freight rates can be so revised as to secure even approximate financial equilibrium within each group. The Railway Companies Association agrees with the general principle of grouping, but suggests five groups covering England, Wales and Scotland as being more likely to obtain the desired financial results. In particular, it divides the Scotch lines between two of the groups, so that there would still be competition for Scotch business. Under the companies' plan all lines north of the Thames would be divided into two groups, northeastern and northwestern, with about 5,000 and 6,500 miles respectively. A third group of 4,000 miles includes a system from London to the west, with all the Welsh lines. A fourth, with 2,500 miles comprises all lines south of the Thames and the fifth is composed of all the London local lines.

The amalgamation or consolidation of capital of the several companies comprised in each group appears to be made compulsory in the new bill, but the companies consider that, although such amalgamation may become expedient, it should be optional. As to financial returns, the bill provides that some prescribed authority shall determine rates which, with efficient and economical management, will enable the companies to earn a net revenue substantially equivalent to the combined net revenue of all the companies absorbed in the group. A difficulty has arisen from the stipulation that this revenue is to be determined upon a pre-war basis.

It is agreed by the companies that if this term is taken to mean that the return to capital is not to exceed the pre-war rate, it would be impossible to raise on reasonable terms the additional capital which is required for further railway development. The companies probably would accept a provision to the effect that the future net revenue is to include a return on capital which will place railway investments in the same relation to other industrial investments as in pre-war days.

A statement issued by the Railway Companies Association points out that the principal purpose of the financial arrangements is to make the railways self-supporting in the hands of the present owners, to put an end to State subsidies, and to reduce or eliminate serious claims against the government arising out of its present possession of the railways. In view of the difficult problems of finance, administration, organization and operation the association considers that it will not be practicable to have the groups ready for operation before 1924. It is suggested, therefore, that when the existing government control ceases in August, 1921, the government shall continue the present agreement until January, 1924, and shall meanwhile guarantee the companies the same net receipts as in 1913.

Railway Labor Representation

A serious point at issue is the provision of the government railway bill that the railway managing boards shall be composed not only of directors elected by the proprietors, but shall include also the chief officers and workmen elected by the employees. Strong objection is made by the companies to having labor representatives on the boards, especially as the employees have no financial interest or responsibility in the companies, so that matters involving heavy expenditures and possible consequent reduction in dividends would not affect the employees to any extent. This participation in the management is advocated vigorously by labor interests, but the companies consider that it "is unjustifiable, wrong in principle and would be subversive of discipline."

Further, the companies urge that as the government accepts no financial responsibility for the railways, there is no ground for imposing upon them a plan which radically affects the charter of a company and its powers of management, and which interferes with the right of shareholders to choose their own directors. On the other hand, the companies recognize the possibility of advantage in giving the employees a part in dealing with operating problems. The Railway Companies Association therefore suggests the appointment of committees composed of officers nominated by the board of directors and employees elected by the employees from their own ranks, each committee having a director as chairman.

A National Problem for Engineers—

Taking Up The Slack in Industry

Possibilities in the Elimination of Wastes and the Intelligent Direction of Productive Power to Reduce Unemployment and Labor Friction

By Herbert Hoover,
President, American Engineering Council.

At the meeting held Feb. 14, in Syracuse, N. Y., of the American Engineering Council—the governing body of the Federated American Engineering Societies—Herbert Hoover, the council's president, outlined the possibilities of the survey of industrial wastes which the federation has organized. An abstract of his address follows:

THE federation of engineering societies has been brought about solely that we might secure for public service the collective thought and influence of 100,000 to 200,000 of our professional engineers. This great body of men in administrative and technical service penetrates every industrial avenue and thus possesses a unique understanding of many of our intricate economic problems and an influence in their solution not equalled by any other part of the community. Wanting nothing from the public, either individually or as a group, they are indeed in a position of disinterested service. This federation has initiated services to the public in many directions.

I propose to deal with only one measure of this service today. Your council has organized a preliminary survey of some of the weaknesses in our production system. This survey will attempt to visualize the nation as a single industrial organism and to examine its efficiency toward its only real objective—the maximum production. In a general way this inquiry will bear upon the whole question of deficiency in production—industrial waste in a broad sense.

Kinds of Waste

The waste in our production is measured by the unemployment, the lost time due to labor conflict, the losses in labor turnover, the failure to secure maximum production of the individual due either to misfit or lack of interest. Beyond this, again, is a wide area of waste in the poor co-ordination of great industries, the failures in transportation, coal and power supplies which re-echo daily to interrupt the steady operation of industry. There are other wastes due to lack of standardization, to speculation, to mismanagement, to inefficient national equipment and a hundred other causes. There is a certain proof of deficient production by comparisons of our intense results in 1918, when, with 20 per cent of our man-power withdrawn into the army, we yet produced 20 per cent more commodities than we are doing today. We are probably not producing more than 60 or 70 per cent of our capacity; that is, if we could synchronize all national effort to maximum production, we could produce 30 or 40 per cent more commodities and service. Our national machine is today doing worse than usual, as witness the 3,000,000 idle men walking our streets. One part of the human measure of this shortage in production is the lack of necessities or comforts to them and their families and their anxieties as to the future.

No one will ever suppose that it is possible to bring national productivity up to the full 100 per cent, but the whole basis of national progress, of an increased standard of living, of better human relations, indeed, of the advancement of civilization, depends upon the continuous improvement in productivity. While we currently assume that great advances in living standards are brought about by new and basic inventions, yet ever a greater field of increasing standards lies in the steady elimination of wastes. The primary duty of organized society is to enlarge the lives and increase the standards of living of all the people, not of any special class. We are, therefore, proposing to make a preliminary examination of the volume of waste in certain industries, the proportions that lie in each field of fau And no engineering report is worth the paper it is writt upon without constructive suggestions in remedy.

Productive Power Must Be Shifted

There is ofttimes a superficial dismissal of this subject of maximum production on the assumption that there are positive limits in production due to oversupply. Such assumption has no proper foundation in the broad view of industry as a whole. Too much economic thought on production has delimited its boundaries by the immediate volume of demand of a given commodity. There is no such thing as the nation overproducing, if it produces the right commodities. The commodities or services produced by the whole nation are capable of absorption by the whole nation, if they are of the right character. In other words, if we could attune the whole industrial world to the highest pitch, agriculture as well as manufacture, an increasing production would mean a directly increasing standard of living. When ten men or one hundred million men divide their united output, they can by doubling their output have twice the amount to divide. The problem in doubling output is to direct it to commodities or services that they can use. There is no limit to the increase of living standards except the limitations of human strain, scientific discovery, mechanical invention and natural resources.

It is true enough that any particular commodity or service can be overproduced, for each will reach a saturation point in demand when all the members of the community have been supplied. The absorption of increased productivity lies in the conversion of luxuries of today into necessities of tomorrow, and in spreading these through the whole population by stimulation of habit and education. Wheat bread, railways, good roads, electricity, telephones, telegraphs, automobiles and movies were once luxuries. They are still luxuries to some parts of the population.

It is but a corollary that certain commodities can better be produced for exchange for commodities from outside our boundaries more appropriate to our needs. Today we have capacity for production of some commodities not only in excess of our home need, but even beyond export demand under present financial conditions. As a matter of practical remedy, we must either reorganize these financial relations or abandon some part of this kind of production and turn our idle men to making things of which we are not yet fully supplied.

To put the matter in another way, there is no limit to consumption except the total capacity to produce, provided the surplus of productive power is constantly shifted to new articles from those that have reached the saturation point of demand. For instance, we have the productive capacity wasted today that would improve the housing conditions of our entire people to the level that perhaps only 50 per cent of them enjoy—and at the same time not encroach upon our established necessities. I am not suggesting that the forces of production can be shifted by imperial direction. The practical thing that can be done is to eliminate some of the wastes and misfits in our production and depend upon the normal processes of business and human desires to absorb them.

The largest area of waste lies in the large periods of slack production and unemployment due to the ebb and flow of economic tides between booms and slumps. The ideal would be steadily increasing production—an ideal of no likelihood of exact realization because of inability ever to gage the advance in growth of consumption or the approach

of saturation. On the other hand, there are certain possibilities of stabilization worth consideration. For instance, we can classify labor into that engaged in the production of and in the service from this equipment. Our studies of industries as a whole show that we usually expand our equipment just at the periods of maximum demand for their products, instead of doing our plant expansion during periods of slack consumption. We thus make double demands on labor and we doubly increase unemployment in periods of reduced consumption. That is, indeed, one of the factors in our great unemployment today.

Everyone knows that, for our normal productivity, our transportation facilities are today inadequate. We know that we are insufficiently housed, insufficiently equipped in our public roads and our public utilities; that we need an entire revision of our power supply, that we need expansion of our waterways, and yet armies of idle men are walking the streets. The reasons why this occurs are not far to seek, in that it is at times of high productivity that capital is most easily obtained. It is then that the necessity of increased equipment most impresses men's minds and it is the high hopes of these periods that lead them into the adventure of expansion. Nor is it possible to expect that all industry could be so stabilized as to do its capital construction in periods of depression in commodity demand. Nevertheless, there are some industries that could, by co-operation of the government and co-operation among themselves, be led in this direction. More particularly does this apply to railways, telephones, telegraphs, power supplies and other public utilities, and to the expenditure upon our state, municipal and national public works.

Another variety of intermittent employment, and thus great waste, lies in certain industries now operating upon an unnecessarily wide seasonal fluctuation, as for instance the bituminous coal industry. This is today one of our worst functioning industries. These mines operate seasonally and erratically. They proceed from gluts to famines, from profiteering to bankruptcy. As already determined by our engineering bodies, the men who mine our coal find work only 70 per cent of their time. In other words, there are 30 per cent more equipment and 30 per cent more men attached to this industry than are necessary if it were stabilized to continuous operation. The mining engineers have already pointed out the directions in which remedy lies—through storage, through railway rate differentials and other remedies. Through constructive action an army of men could be released from this industry of necessity to convert some luxury into a necessity of tomorrow. This is no plan to control prices or profits, although through it both the producer and consumer in coal could be placed upon a sounder basis than today. The interest of the consumer and producer is, however, even less important than relief from the intermittent employment and unemployment within this industry that today brings a train of indefinite human misery and some of our lowest standards of living.

Labor Friction

The second largest area of waste in productivity is the eternal amount of labor friction, strikes and lockouts. The varied social and economic forces involved in this problem need no repetition here. Fundamentally this is not alone a struggle for division of the results of production between capital and labor, but there is also a loss greater from strikes and lockouts in the element of purely human friction and loss outside the area of dispute on wages and hours. The growth of industry into large units has destroyed the old mutuality of interest between employee and employer. Our repetitive processes have tended to destroy the creative instinct and interest in employees; at times their efforts sink to low levels indeed. We will have to reorganize the whole employment relationship to find its solution. There is great promise in this field during the past two years, and the progress in this matter is one of the subjects of our inquiry.

Yet another variety of loss lies in the unnecessarily faulty distribution of our labor supply due to seasonal and to shifting demands. An adequate national employment service is the first need to reduction of these wastes.

Probably the next largest fraction of waste in productivity lies in a too high degree of individualism in certain basic products and tools. In other words, a standardization of certain national utensils makes for economy in distribution, in operation and in repairs. The necessity of maximum production during the war opened a great vista of possibilities in this section. Such standardization as car couplings, or wheels, and cars generally, represents real progress in this direction. These possibilities lie in a hundred directions. There are all sorts of cases from sizes of chains to the size of automobile wheels. Today dozens of different sizes are placed in the market by manufacturers and entail not only special equipment and skill to produce these many varieties, but also great stocks are required in distribution and losses are entailed due to lack of interchangeability. It is certain that there are a great many articles of every-day use in which the manufacturer would be glad to undertake some co-operation in standardization, from which the saving in national effort would be interpreted not into millions but into billions of dollars. This does not mean that we stamp the individuality out of manufacture or invention or decoration; it means basic sizes for common and every-day things.

Another type of waste lies in our failure to advance our industrial equipment. The Super-Power Board will demonstrate the saving of 25,000,000 to 50,000,000 tons of coal annually by the electrification of our Eastern power supply. The St. Lawrence Waterway Commission will demonstrate the saving of five to ten cents a bushel to the farmers of fifteen states by unlocking the lakes to ocean going vessels. Nor will this added efficiency to our national transport injure our present systems of canals and waterways, for we have ever found that the prosperity of an industry blesses them all.

Nor do we believe it is necessary to effect these things by the government. The spirit of co-operation that has been growing in our country during the last thirty years has already solved many things; it has standardized some things and is ripe for initiative toward co-operation of a widespread character. The leadership of our federal government in bringing together the forces is needed. No greater field of service exists than the stimulation of such co-operation. The first step is sane analysis of weakness and sober proposal of remedy. If the facts can be established to an intelligent people such as ours, action is certain, even if it be slow. Our engineers are in a unique position for this service, and it is your obligation to carry it forward.

Would Meter Water Used by Government

A joint resolution requiring the metering of all water used for federal and district purposes in the District of Columbia and the charging of its cost against the various public departments and institutions using it was introduced in Congress on Jan. 29. The bill provides:

That the Commissioners of the District of Columbia shall, within six months after the passage of this joint resolution, cause water meters to be installed in the buildings occupied by the executive and municipal departments and governmental institutions in the District of Columbia wherein such meters are not already installed, and to ascertain from the U. S. Bureau of Standards the cost of impounding and filtering the water used in such buildings, and upon such information shall base the rates of charges to be made therefor, taking into consideration the cost of the service, the consumption of water and the relative investment of the Government of the United States and the Government of the District of Columbia in the water-supply system of the District of Columbia. The cost for the use of such water service shall be paid to the water department of the District of Columbia by and out of appropriations for the respective executive and municipal departments and governmental institutions to which it is furnished, under existing regulations governing the rendition and payment of water bills or under such modification of such regulations as the Commissioners of the District of Columbia may deem necessary.

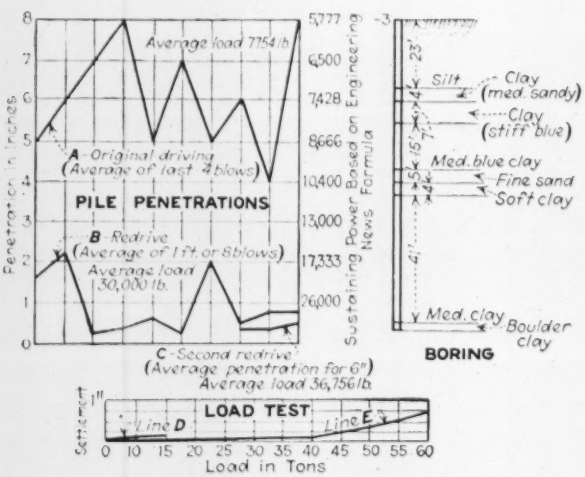
Pile Load Based on Penetration In Redriving

Loading of Foundation Piles in Clay Computed from Resistance to Hammer on Day After Initial Driving

By J. Frank Mullen
Boston Building Department

During the construction of the new home office building for the John Hancock Mutual Life Insurance Co. at Boston, Mass., being built by L. P. Soule & Son Co. as contractors, question arose between the engineer-in-charge and the Boston building department as to what loads the piles were capable of sustaining.

The site was excavated to El. —3, which was 1 ft. above pile cut-off. Borings indicated that a stratum of fairly stiff clay about 16 ft. thick with top about El. —25 extended throughout this site, overlying a medium blue clay, and that boulder clay or hardpan was found at —102. When the subcontractor for piling, Scully Foundation Co., drove foundation piles 30 to 35 ft. long into the clay a final penetration of 4 to 8 in.



PILE-DRIVING AND LOAD TEST DATA SHOWING GAIN IN BEARING POWER WITH TIME

per blow was noted. The city building law limits the bearing power of piles to the value given by the *Engineering News* formula, $\frac{2WH}{P+1}$. Applying this formula to the case would make it impossible to space enough piles under the proposed building. As it was suspected that the material consolidated around the piles after driving, the last pile driven each day was left one foot high and was driven to its proper grade on the following morning. These piles showed much smaller penetration after resting over night. They are referred to as "redrive tests."

Two static load tests were made, one on a single pile loaded to 15 tons at the rate of five tons per day, and another on three piles loaded at the rate of 15 tons a day until the total load was 60 tons. The ultimate load was allowed to remain 24 hours before the final reading was taken.

Herbert A. Wilson, city building commissioner, after a careful study of the records of the initial driving, the redrive tests and the load tests was convinced that the results warranted a much greater safe load than that given by the *Engineering News* formula. Nevertheless, holding that the law required the formula to be applied to the penetration obtained at the time of initial driving, the commissioner felt obliged to disallow the designed load on the piles. Frederick A. Waldron, engineer-in-charge for the company, appealed from this decision to the city Board of Appeals. He asked that, on the basis of the driving and load-test results, a maximum future load of 11 tons per pile be allowed in that portion of the building which is to be built to four stories now and ten stories 25 to 30 years hence, and a maximum load of 10 tons in the center building, which is to be erected at once.

The data of the driving and load test have been plotted in a diagram reproduced herewith. Link *A* represents the penetration obtained in the initial driving, for ten piles; the *Engineering News* formula gives an average working load of 7,754 lb. Line *B* shows the penetration of these ten piles when redriven 1 ft. twenty-four hours after the initial driving; the formula now gives an average load of 30,000 lb. per pile. Line *C* shows the penetration of three piles redriven a further 6 in. one month later; the average load by the formula has now increased to 36,756 lb.

All piles shown on the chart were spruce, 30 ft. long, 10 in. butt and 6 in. tip diameter, driven under a 10-ft. fall of a 2,600-lb. hammer. The plotted results are generally representative of the penetrations of over 10,000 piles that were driven.

At the hearing of the Board of Appeals, Charles R. Gow and J. R. Worcester, consulting engineers of Boston, spoke in favor of allowing the proposed pile loads of 10 and 11 tons. The decision of the board adopted the same view, allowing the proposed loads as warranted by the soil conditions.

Drying Periods of Various Woods

Douglas fir, yellow pine, incense cedar and spruce are the fastest drying species (by kiln) of wood, according to the table below, prepared by the Forest Products Laboratory. Any dry kiln in which the circulation is adequate and the temperature and humidity are properly controlled should produce in the time specified material of high quality, free from visible degrade, if not quite equal in strength properties to air seasoned stock. The table gives the approximate time required to kiln dry, under mild conditions, 1-in. plain sawed green and partially air-dry stock with 25 per cent moisture to a moisture contact of 6 per cent, based on weight of dry wood.

Species	Days Drying Time: Green from the Saw	Days Drying Time: Partially Air Dry
Hardwoods:		
Swamp Oak	45 to 50	20 to 25
Northern Oak	30 to 40	17 to 20
Walnut, Cherry	22 to 30	13 to 15
Mahogany, Beech	16 to 22	9 to 12
Tupelo, Gum	20 to 26	10 to 14
Birch, Ash, Sycamore	15 to 21	9 to 12
Poplar, Basswood, Chestnut, Butternut, Elm, Cherry	8 to 10	4 to 6
Maple, Hickory	17 to 23	9 to 13
Conifers:		
Western Larch	9 to 12	4 to 6
Cypress, Redwood	10 to 18	6 to 8
Douglas Fir, Yellow Pine, Incense Cedar, Spruce	4 to 6	3 to 4

For stock more than 1 in. thick and less than 3 in. the drying time is proportional to the thickness. Quarter-sawed stock requires from 25 to 35 per cent more time than plain-sawed. Drying to 10 or 14 per cent moisture takes from one-quarter to one-third less time than drying to 6 per cent.

Road Builders Discuss Highway Development

Abstracts of Papers Read at the Convention of the American Road Builders Association at Chicago.

THERE are published below, in abstract, some of the papers presented Feb. 9-12 at the annual convention in Chicago of the American Road Builders Association. A brief news report of the meeting appeared on p. 315 of last week's issue.

Traffic Development in Wayne County

BY EDWARD N. HINES
Chairman, Board of Road Commissioners, Wayne County, Mich.

WITH 1,370 miles of highway in Wayne County, Mich., about 80 per cent of the traffic uses about 25 per cent of the mileage. Traffic counts made in 1912 and again in 1920 on six important radial roads show that the number of horse-drawn vehicles is from 3.6 to 20.8 times less in 1920 than in 1912, while automobile traffic, during the same period, has increased from 4 to 7 times and truck traffic has increased from 8 to 29 times. The total traffic is 2 to 4 times greater in 1920 than in 1912. On one road the daily average for a week was 10,500 vehicles, but on other roads the average was between 2,000 and 3,500.

The county system consists of trunk lines radiating from Detroit, three belt lines and secondary roads connecting local centers. The radial roads carry the heavy traffic noted. It is now planned to increase the number of radial routes by seven heavy-duty roads paved 36 ft. wide on a 100-ft. right of way. Concrete paving is contemplated. Besides structural maintenance, main roads are kept clear of snow in winter. About 45 miles of road are lighted and lighting is being extended as rapidly as possible. It is found that lighting encourages motor truck traffic at night and so reduces congestion during the day.

Highway Bonds for Investors

BY H. C. SYLVESTER, JR.
Vice-President, National City Co., New York

MONEY borrowed to finance highway construction should be repaid as soon as the principal and interest can be raised by taxation without unreasonably burdening or oppressing the taxpayer. Under present conditions it is impossible to forecast the time when reconstruction will be necessary, but before that time arrives the bonds issued to finance the original construction should have been retired. No highway bond should run longer than 30 years. If the locality cannot pay sufficient taxes to retire a highway debt within 30 years, there is grave question whether the highway should be undertaken.

Issue a security which will be attractive to the investor. If a highway can be financed by State bonds the money will be borrowed at a lower rate than if it is financed by county, townships or district bonds. County bonds, similarly, are a much better security and much more attractive to investors than are township or district bonds. Bonds should be paid from an ad valorem tax and no limit should be placed on the rate of tax which may be levied. While a security based upon a special assessment may be marketable, the price paid in the shape of interest and discount will be much greater than in the case of an obligation secured by an ad valorem tax.

Serial issues are preferable to flat time issues. The serial issue immediately absorbs the money raised by taxation to pay the principal; the creation of a sinking fund is rendered unnecessary. The accumulation of large sums in the city treasury in the name of a sinking fund, possibly bearing a small rate of interest, while full interest is payable on the city's debt, is avoided. The serial issue automatically conforms to the principles of economic financing, and even if compared to cases when the sinking fund is efficiently administered results in a saving to the municipality. The serial method of dispensing with a sinking fund avoids the danger of loss from improvident or negligible management of sinking fund money, or from dishonesty or incompetence. It removes the temptation so to employ large sums of money as to further personal rather than public aims, and if consistently carried out, it avoids incurring the expenses for the management of a sinking fund. But a further and much greater advantage rests in the fact that if a serial issue be made the danger of a refunding at maturity will be avoided.

Contractual Relations in Highway Construction

BY W. A. ROGERS
Bates & Rogers Construction Co., Chicago, Ill.

THE problem of contractual relations in highway construction has three phases—the duty of the engineer, the duty of the contractor and the duty of both contractor and engineer to the public.

Duties of Engineer.—The contractor is entitled to have described in the specifications just what is wanted and can be followed. Incorporating in specifications clauses which are practically impossible of fulfillment with the thought that better work will be secured by fixing almost impossible standards is less apt to secure this result than if the specifications provide for what is reasonably possible of fulfillment. It has been said that drastic specifications have sometimes been made for highway work with the laudable purpose of scaring away unsatisfactory and irresponsible contractors and putting into the hands of the engineer requirements which could be used to advantage in the case of irresponsible contractors, and on the other hand, could be eased up for those contractors who were doing satisfactory work. This is entirely wrong. It has just the opposite effect. When a specification is drawn which, in any respect, is not workable, it casts a cloud on the entire document and the responsible contractor feels as though he were being placed in a position where an irresponsible inspector or engineer might cause him serious trouble and expense.

Contracts and specifications should be definite and clear in the placing of responsibilities. The furnishing of materials by the State is both wrong in principle and not productive of the best results, either as to harmony between the parties or as to decreased cost. It injects

into the work a question of divided responsibility. It makes the State responsible for something which is part of the construction and on which the progress and economical operation of the work are vitally dependent. If the materials are not delivered in the order and at the rate which the work requires the cost increases and the engineer, who is not paying the bills, can hardly appreciate this effect as does the contractor.

If, however, the engineer does specify that the State shall furnish any of the materials, then the State should assume the full responsibility for delivery. If the State fails to deliver its materials as required by the work, thus adding to the cost of the work to the contractor, then in the interest of fairness and satisfacory relationship the state should assume the responsibility for such failure. Placing on the contractor a risk over which he has no control is just adding another gamble to a game which is hazardous enough without it. Contracts and specifications should be so drawn, in the interests of both parties, that they are as free as possible from risks of this kind.

Supervision of the work, another duty of the engineer, should be delegated in the field only to men of good judgment and experience. Inexperienced, incompetent field supervision causes delay to both State and contractor and increases expense. Bear in mind that the data on which a contractor of experience bases his bid price is the cost of previous work of similar character interpreted in the light of the conditions of the job on which he is figuring. In his previous costs are reflected the cost of not only every onerous clause in the specifications, but also the results of unfair and incompetent engineering supervision. It is, therefore, necessary and desirable that engineers in charge of highway work should be thoroughly competent.

Competent engineers are entitled to compensation proportionate to their skill and experience. It is a mistaken economy to save on highway engineers' salaries. Well paid experienced engineers make possible the best and most economical highway work.

Duties of Contractors.—Each job should be studied carefully and properly equipped with plant. Whether the delivery of materials shall be by truck or by industrial plant should be settled. The method adopted for unloading and storing materials is a very important item and the success or failure of the work is dependent to a large degree on the plant and equipment adopted. The contractor must provide an adequate and satisfactory supply of water. Then he must co-ordinate all of the different elements, consisting of materials, water supply and an efficient crew to build the finished highway on a subgrade, finished to an exact surface. He must then see that it is properly protected and properly cured. Above all, the contractors' organization should be made up of men who are willing to meet the engineers half way, who take pride in the quality of their work and who are anxious to give the State an honest job. Only in this way can the highway contractor be successful.

Duties to the Public.—We are building the most carefully constructed and most costly system of highways ever made and yet every year miles of these highways are damaged because the weight of some trucks which the automobile manufacturers are developing is heavier than the roads were designed to bear. The significant point is that such trucks represent a comparatively small percentage of all which use the highway. In the interest of the public which bears the cost of constructing these highways, some action looking to the limitation of the size of trucks must be taken. Who are better able to who more responsible for settling this problem than the highway engineers and highway contractors who know the science of constructing the roads in question and who are blamed when they fail to stand up under the traffic? In self-protection as well as out of regard for the public interest it is our joint responsibility to see that proper action is taken.

Highway Development in Alaska

By Major James A. Steese
Corps of Engineers, U. S. A., President Alaska Road Commission

SINCE road construction under the Alaska Road Commission was begun in 1905, there have been built 1,031 miles of wagon road, 636 miles of sled road and 3,223 miles of dog team trail at a total expenditure including maintenance of about $5,180,000. Construction and maintenance costs per mile have averaged about as follows:

Type	Construction	Maintenance
Wagon road	$2,500	$250
Sled road	300	25
Trail	100	10

Generally the policy of development has been to build trail which is converted into sled road and then into wagon road as traffic demands and finances permit. A ten-year program has been prepared which involves an expenditure, including $200,000 a year for maintenance, of $1,000,000 annually. This will provide an additional 834 miles of wagon road, 464 miles of sled road and 71 miles of trail, all combining with the existing roads to form a co-ordinated and consistent system.

Discussion

A. R. Hirst, State Highway Engineer of Wisconsin.—Four tasks in the improvement of relations between highway engineers and contractors overshadow all others. The first is to ensure competent state highway engineering organizations by divorcing highway departments from politics and by paying salaries which are large enough to secure and retain competent engineering direction of highway work. The second is to minimize risk in a hazardous business by confining operations to a mileage of highway which, with the money and equipment capital available under the conditions, can be completed in one season. The third is to keep and learn costs so completely and thoroughly that bids are made with a knowledge of all the items involved and their reasonable cost. The fourth is to study and develop means of reducing the cost of highway construction to the end that the building of roads is encouraged and the people loyally served by the business which is getting their money. If contractors will throw the force of their influence to secure appropriations and salaries which will enable state highway departments to build up and keep reasonably permanent engineering organizations of competent men most of the problems of contractual relations will solve themselves.

R. G. Collins, Keystone Construction Co.—Contractual relations will adjust themselves when contractors learn highway construction so thoroughly that they will not underestimate costs and name bidding prices which are too low. Dispute with the engineer or the specifications cannot remedy conditions arising from a bid so low that a contractor with reasonably good management cannot

make a profit. If he can make a reasonable profit there is seldom any dispute. Contractors, before they theorize about contractual relations, need to educate themselves in highway construction costs and then base their bids on this knowledge.

Problems in Road Drainage Which Require Study

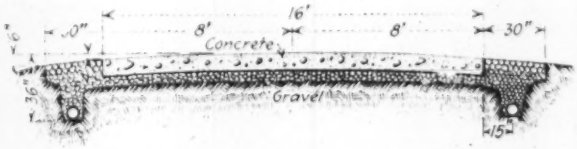
By Frank H. Eno

Professor of Municipal Engineering, Ohio State University, Columbus, Ohio

UNDER present road construction practice there is seldom a paved road that does not provide perfect cross-drainage, at least from the center of the road to the edge of the paved way. Beyond that point perfection in drainage is difficult. A summary of experience and of outstanding problems in road drainage is as follows:

1. Unprotected earth shoulders are easily rutted during spring thaws and wet seasons. These ruts provide easy access for water to the subgrade. Building water-proofed hard shoulders along a pavement serves a double purpose, it protects the subgrade from water and it adds to the width of the road. It may prove to be cheaper than rebuilt pavements.

2. Dust-filled grass shoulders should be eliminated in order to prevent shoulder seepage into the subgrade.



DRAINAGE FOR PAVED ROAD IN IMPERVIOUS CLAY

3. Uncleaned ditches add largely to the expense of road maintenance, are unsightly, and in many cases are the direct causes of complete road destruction. The elimination of the ditch so far as is possible and the substitution of subdrainage, it is believed, will tend toward economy.

4. The practice of rolling clay subgrades should be carefully investigated to determine whether rolling increases capillarity, and if so whether serious harm is done.

5. The whole question of capillary action of water in subgrade soils needs investigation to determine what treatment is necessary with different soils in order best and most economically to prepare the subgrade for the road.

6. The slaking and saturation actions of soils, in fact the whole range of soil and water reactions, should be investigated in order to formulate specifications which the engineer may use for any soil situation encountered in the subgrade.

7. Advantage should be taken of natural soil drainage by building the road on top of the original soil, as far as possible. Minimize the cuts. Multiply the culverts. Conduct the water away from the road into natural channels as frequently as possible.

8. The question of how to prevent center longitudinal cracks in monolithic roads, and whether swelling soils have anything to do with these cracks, is propounded for investigation and observation. The presence of water in the soil is at the base of both of these actions.

9. The treatment of non-drainable soils to prevent them from being churned into plastic, unstable masses under the road is a final problem suggested to the road engineer for solution. The porous drainage course beneath the foundation is offered as one solution.

Tests of Water Action on Clay Soils

Different soils act differently in the presence of water. All of them, with the exception of sand, are made less stable when partially or totally saturated with water. The stability of some soils increases with the water content up to a certain degree of saturation and thereafter rapidly decreases as the degree of saturation continues to increase. Soils vary in their capacity for saturation. Tests now being carried on in the road laboratory of the Ohio State University Experiment Station show some remarkable differences in this respect. One yellow clay that absorbs water readily will hold 28 per cent of its weight of water, while another yellow clay, which absorbs slowly, holds 59 per cent. A grayish clay soil holds 57 per cent, while two black muck soils hold, respectively, 38 per cent and 70 per cent of water.

While making slaking tests it was noted that a variation in the water content of the clay cylinder at the time it was plunged into the water bath greatly affected the rate of slaking. Evidently the condition of the soil at the time of a long continued rainstorm, or of a substratum of clay at the time of the spring thaw, may variously affect the final results as to whether great harm or small harm is done to a paved road.

A few of the clay soils tested in the laboratory are so fine grained and dense that water will only pass through them by capillarity. The attraction between the clay and the water appears to be so close that the water will not be transmitted to a more porous medium. A bowl ½ in. thick shaped out of these clays will hold water for hours without showing additional moisture on its outer surface.

Based upon such evidence the question immediately arises, of what value is tile underdrainage laid in that kind of soil? Do not be deceived because this soil does not permit water to flow freely through it, do not think that it remains stable and that it retains a high bearing power. One of the worst failures on a road in Vinton County, Ohio, occurred where this kind of clay outcropped in the subgrade. The problem of how to treat road foundations through this kind of clay has yet to be solved.

The writer has suggested for trial in Ohio, where dense clay soils are encountered at subgrade elevation, that the road bed trench be deepened from 4 to 6 in. and that this depth of coarse, clean gravel or a uniform sized, clean, broken stone be spread beneath the regular foundation. This porous drainage course should be frequently connected with the side ditches or subdrains in order to free it from the collected water.

Oregon Drainage Association

At the sixth annual meeting of the Oregon State Drainage Association at Portland, Jan. 6, John W. Cunningham, consulting engineer, said that alkali which had laid on the ground an inch thick, as a result of several years irrigation without drainage, had disappeared within three years after the drainage system had been completed to such an extent that a good yield of alfalfa was raised. Mr. Cunningham asserted that special "laundering" of the soil, as sometimes advocated, is not necessary in eastern Oregon.

Percy A. Cupper, state engineer, pointed out that the Oregon drainage district law allows united action in drainage projects, permitting larger and more expensive schemes to be carried on than were possible previous to its passage. He said further that 150,000 acres are now organized under this act, and that bonds amounting to $530,000 have been certified by the state board.

That tile drains should have a capacity of about ¾ in. in 24 hr. instead of either ½ in. or ¼ in., was the opinion of Ward Cretcher. While a ½-in. capacity is often too small, he said that it is often needless to go to more than double the expense to provide for twice the run-off.

Tule lands in the Klamath Lake region, which are practically worthless, have been made to yield 45 bushels of rye per acre by drainage, said E. A. Geary, 26 bushels being the average yield. Mr. Geary added that in his part of the state a great need was felt for a cheap power ditching machine for small ditches.

Samuel R. Brown, of Gervais, was elected president and Prof. W. L. Powers, of Corvallis, secretary.

New Facts and Studies on Concrete

Extracts and Abstracts of Papers and Reports Presented at the Annual Meeting of the American Concrete Institute, Feb. 14-16, 1921.

Designing Concreting Plant

THE special committee on contractors' plant during the past year has made an exhaustive study of the different types of plants used to handle concrete on building construction. In the future other kinds of construction will be studied, but the present specifications include only reinforced concrete buildings. In the report there is first a specimen layout of seven typical plants with tabular and diagrammatic comparisons between the different types. A method is advocated whereby the proper kind of plant may be determined by a diagrammatic analysis which considers cost of plant and installation and cost of operation of the separate parts of each plant with a final reduction which gives the comparative costs of producing a yard of concrete with each of the types of plant. The report further has descriptions of some separate concrete plants analyzed in their elements.

Studies on Cracking of Stucco

Continuing his long series of tests into the nature of stucco, J. C. Pearson, of the United States Bureau of Standards, reported on a new set of tests in a paper entitled, "Shrinkage of Portland Cement Mortar and Its Importance in Stucco Construction." By means of a very accurate microscopic instrument, called the "comparator," by which could be measured the minute variations in an established base line on a small piece of concrete from the beginning of its setting until final set, the expansion and contraction of a concrete mortar during the setting period was measured for a number of different mixtures. It was found with water-tight forms that while occasionally there was an initial expansion, there was as a rule a continuous contraction from the begining almost as soon as the concrete was placed and continuing in a minor degree for some months. Such a contraction would in a stucco wall, of course, result in map crazing. The investigators, therefore, decided that the tightness of the forms had something to do with this pronounced contraction and made a number of tests with plaster of paris forms which permit a certain amount of absorption of the water in the concrete. When these bases are dry their absorption is high, but this can be controlled by wetting with measured quantities of water prior to filling the forms. It was established that this absorption or "suction," as the plasterer would call it, had a very great effect upon the time of set or stiffening of the mortar. If mortar was placed in a form with a dry base set occurred almost before the plugs could be placed in position and initial readings taken. Slight wetting of the plaster bases deferred this set until earlier readings were taken, say from 15 to 20 min., and heavier wetting deferred the set still longer. Correspondingly, the amount of contraction was reduced so that a measure, not yet complete or accurate on account of the limitations of the tests, was reached which tended to establish the proper amount of moisture at the base of the form for proper stuccoing.

Status of Government Concrete Ships

THE committee on concrete ships and barges gives a paragraph to each of the twelve concrete ships built by the government during the war. These data may be abstracted as shown in the accompanying table. In addition the committee notes that the canal barges have been none too successful—on account of weight and ease of puncture—that there are no difficulties in design or construction in concrete ships, but that costs are high and operation complicated.

STATUS OF GOVERNMENT CONCRETE SHIPS, JANUARY, 1921

Ship	Type	D. W. Tonnage	Built at	Launched	Delivered	Remarks
Polias	Cargo	3,500	Flushing, L. I.	May, '19	Oct., '19	Abandoned on rocks, Penobscot Bay, Feb., 1920.
Atlantus	Cargo	3,000	Brunswick, Ga.	Dec. '18	Oct., '19	Operated by Shipping Board (tied up)
Cape Fear	Cargo	3,500	Wilmington, N. C.	July, '19	Nov., '19	Sunk in Narranganset Bay, Oct., 1920
Sapona	Cargo	3,500	Wilmington, N. C.	Oct., '19	Jan., '20	Operated by Shipping Board (tied up)
Dinsmore	Tanker	7,500	Jacksonville, Fla.	June, '20		
Moffit	Tanker	7,500	Jacksonville, Fla.	July, '20		
Latham	Tanker	7,500	Mobile, Ala.	July, '19	May, '19	Salvaged from Tampico Breakwater, 1920 (for sale).
Selma	Tanker	7,500	Mobile, Ala.	July, '19	May, '20	Salvaged from Tampico Breakwater, 1920 (for sale).
Peralta	Tanker	7,500	Oakland, Calif.	Oct., '20		
Palo Alto	Tanker	7,500	Oakland, Calif.	May, '19	Sept., '20	Operated by Amer. Fuel Oil & Trans. Co.
Cuyamaca	Tanker	7,500	San Diego, Calif.	June, '20	Sept. '20	Operated by France & Canada Oil Transp. Co.
San Pasqual	Tanker	7,500	San Diego, Calif.	June, '20	Sept. '20	Operated by France & Canada Oil Transp. Co.

A New Hooped Column Formula

STUDY of the more extensive tests of hooped concrete columns and of tests showing shrinkage and time-yield of concrete structures has led F. R. MacMillan to propose a new formula for spirally reinforced columns with vertical steel. It was presented in a paper entitled "A Study of Column Test Data." The column tests show that different tests disagree as to ultimate strength capacities of columns but agree rather closely as to yield point and that the column load at the yield point is a function of the ultimate strength of the concrete and the yield point strength of the longitudinal steel, regardless of the hooping steel. The conclusion is that column formulas chould not be based on ultimate strengths as determined in available tests. Looking further into the plasticity of concrete as revealed by continuous flow under a constant load, Mr. MacMillan devises a formula which considers the value of n much higher than the customary 8 to 15 and takes into account the total unit shrinkage in the concrete were it unrestrained. This shrinkage puts additional strain in the longitudinal steel which causes higher stresses than are usually assumed to be present. He proposes to take advantage of these high stresses, which do not

result in failure in the actual columns, thereby saving in steel and in concrete. The formula resulting is

$$P/A = 333\ (1 + 29p) + 15{,}000p$$

where P = total load;
A = total core area;
p = longitudinal steel ratio.

It will be noted that the spiral steel does not enter into this, but the recommendation is that the longitudinal steel be limited between 1 and 8 per cent and spirals be required not less in amount than ¼ of the longitudinal steel and in no case less than ½ per cent.

Test of a Concrete Mixer

PROF. W. K. HATT, of Purdue University, reported the results of a well-considered test on a standard concrete mixer which was designed to study the action of the mixer and the effect of different standards of operation on its output. The paper reports power consumption in relation to discharge and details of operation of interest to concrete users. It was found that strength and consistency increase rapidly as time of mixing is increased from 30 sec. to 1 min. but after that any gain is hardly worth the increased cost, that the manufacturer's stated speed gave best results (in other words, that time factor rather than number of turns of the mixer is the determining factor), and that an early introduction of water to the drum brought correspondingly early strength. The paper further gives some suggestions for future conduct of such tests, which, the author states, are much needed as a step toward better concrete.

Test of Concrete Oil Tanks

PERMEABILITY tests on small concrete tanks containing mineral and vegetable oil have been under way at the Bureau of Standards for over two years and were noted in the "Proceedings" of the Institute for 1919. Since then some additional information has been gained which is summarized in a paper by George A. Smith, of the Bureau, as follows:

Mineral oils covering practically the entire range of fuel oil, have been stored in concrete tanks for nearly three years and have shown no injurious effects upon the concrete.

Cocoanut oil, lard oil, neatsfoot oil and boiled and raw linseed oil have been found to be more or less injurious to concrete.

On the basis of this last series of tests, 1:1½:3 concrete, mixed to a consistency suitable for reinforced-concrete construction and properly placed should be satisfactory for containers of fuel oils whose viscosities are above 0.06 in absolute units, or about 50 Saybolt seconds, at 20 deg. C.

While many of the tests have shown penetration for the lighter oils which are not in excess of permissible losses, the use of concrete tanks for kerosene and gasolene storage would hardly seem warranted under ordinary conditions.

A limited number of tests indicates that the use of hydrated lime or the application of sodium silicate solution is not effective in reducing the permeability of concrete to the lighter oils.

Dam Named in Honor of Jerry O'Shaughnessy

By unanimous action of the City Council of Columbus, Ohio, the new storage dam for the water-works of that city will be named in honor of Jerry O'Shaughnessy, who died recently after some fifty years in the service of the city.

LETTERS TO THE EDITOR

It is the editors' desire to publish here all worth-while letters pertinent to the interests of engineers and contractors. In order that this may be possible contributors are asked to condense their letters to the shortest space consistent with a clear presentation of their ideas.

Antioch Plan and First Engineering Course

Sir—In *Engineering News-Record*, Feb. 3, 1921, p. 233, there appears a communication entitled "The Antioch Plan." A statement is made in this communication to the effect that the department of engineering established at Union College in 1845 "was the first engineering course in connection with an American college."

In view of the facts I would be remiss in my duty were I to permit this statement to stand unchallenged.

Norwich University [located at Northfield, Vt.], chartered by the State of Vermont in 1834, was, by the terms of its charter, bound to furnish a course in civil engineering. In the language of the charter the board of trustees was required "to furnish at said institution constantly a course of military instruction, both theoretical and practical, and also of civil engineering, and the practical sciences generally."

The University was opened for the reception of students in May, 1835. Its first academic year (1835-1836) it maintained (pursuant to the provisions of its charter) a Department of Civil Engineering, "embracing those branches of literature and science which are particularly requisite for the practical and scientific engineer." This course was pursued by eighteen members of the Corps of Cadets during that academic year.

The establishing of this department of engineering at Norwich University antedates the establishing of the department of engineering at Union by ten years.

Norwich University was the first scientific and classical as well as the first military collegiate institution in the United States.

The engineering course established at Norwich University in its first academic year has been maintained throughout the years that have followed. Norwich men are justly proud of the record which its sons have made, and properly jealous of its reputation as the pioneer among collegiate institutions in the engineering field.

CHARLES A. PLUMLEY, President,
Northfield, Vt., Feb. 9. Norwich University.

The Antioch Plan; What to Teach

Sir—Mr. Morgan, in the "Antioch Plan" (*Engineering News-Record*, Jan. 20, p. 108), has, I believe, hit on one of the worst sore spots of our present system of engineering education, that is, our tendency to train men for subordinate positions only. The average engineering student never has a thought of anything but a good technical job, and neither has the average engineer, for that matter. Under the Antioch Plan the whole mental attitude of the student will change, and from the very first day his goal will be, not the top of an engineering department, but the top of a technical business or a large engineering development.

Of course such a training requires the study of subjects not found in our present curricula, and the man who suggests such lines of study usually runs up against a wall labeled, "Our courses are already too crowded!" After about six years as a college student, and another six years as a teacher, I have become enough of a heretic to answer that they are largely crowded with rubbish, so far as the main object is concerned, and considering the limited time available.

But what is the main object of an engineering course? The general opinion is that it is to shoot the student full of facts and knowledge of methods, and that the more

information we cram into him in college the less he will have to acquire after he graduates. Also we fondly dream that every little bunch of information packed in is put there to stay, and hence pure gain, while every one left out is dead loss. Let's be honest with ourselves for once; how many of us really believe that, even on the day he gets his diploma, our graduate remembers as much as one-fourth of what we have taught him, or that one-fourth of *that* information is always on top for instant use at any time? Although we try to "kid" ourselves to the contrary, we really know that our student will forget at least three-fourths of what he has studied, and will have a pretty hazy idea of the rest. And if so much of this information is so readily lost, then why the frantic efforts to cram it in as if we were really able to fortify our man against all possible contingencies?

If we can not turn out graduates chuck full of information, then what *can* we turn out? To my mind the main object of an engineering education is to give a man such a broad outlook that he will know with what subjects he will have to deal as a successful engineer and manager, to acquaint him with the best sources of information on these subjects, and to teach him enough of the elements of each subject so that he can use the sources of information after he has them. We cannot do any more than that anyway, so why not turn our efforts to doing that well?

It seems to me that our problem resolves itself into two questions: What does the student now get that he doesn't need, and what does he need that he doesn't get? We must solve the first before we will have room for the second, but suggestions as to the solution are dangerous, for every suggestion brings a yell out of some one who sees his pet slighted. As a starter let some of our most prominent engineers blow the dust off their books on college algebra, descriptive geometry, analytical geometry, and calculus, take them chapter by chapter and list all the subjects over which they sweat blood for endless hours in college. Then let them cross out all subjects for which they have never had any use, to say nothing of those which they could not use when they *did* need them. How much will be left, and why should the rest absorb valuable time in college any more than Greek or Sanscrit? By the time we similarly shake down chemistry, physics, and even mechanics and the higher courses in technical design, we will have a lot of room to inject a few things that *are* needed by every engineer who makes a real success.

The trouble with the actual elimination of dead wood from a college course is that a present-day college resembles an automobile factory, for instance, in which one department makes tires, another wheels, another bodies, etc., each according to its own sweet will, and in which each department head is a specialist in his own work only, with no clear idea of what is needed for a complete car, but jealous of any dictation from those who do know. The idea of making anything on earth under that system, except college graduates, would be admittedly absurd, and why the single exception?

Now what does the student need that he does not get? The greatest need perhaps is for elementary business training. It probably is not an exaggeration to say that the majority of young engineers are like little children so far as real business affairs are concerned, and most new graduates, although they may think they know how to design a suspension bridge, cannot even balance a simple expense account. They do not know the cost of the most common engineering materials or how to estimate the cost of the simplest structures. Let's transfer about eighty per cent of our mathematics from such things as hyperboloids (whatever they are) to dollars and cents. A study of efficiency methods and the management of labor will be worth more than a study of water, steel, or gas analysis to a civil engineer, and as a rule will interest him a whole lot more. I tried to introduce such things in a small way with my students, and the response was certainly gratifying. The students voluntarily got up plans for increasing the efficiency of small construction jobs around the campus, etc., and an "engineering assembly" at which a number of seniors tried to sell various types of paving to a mock Commissioners Court, was packed to the doors.

Anyone who would have the temerity to suggest a course in etiquette as a part of an engineering education would become the target of endless ridicule, but are there not many engineers who have been hanicapped in their professional careers by a lack of ease in social affairs? Instruction along this line is, I believe, a part of the training given at West Point, and any English course might at least include a few lessons on formal social correspondence.

No commencement address is considered complete without an allusion to the fact that the world looks to the college graduates to be leaders in their communities, and some engineering graduates become leaders largely because they are college graduates, but I do not think that is often because of the training in the details of technical design which was given them by their professors. It is more apt to be the so-called "outside" college activities which develop leadership. So far as anything that his studies have taught him is concerned, the engineering graduate knows about as much as a new-born babe regarding his obligations as a citizen. I have found few seniors who knew much even about their city and county government, or who cared anything at all about it. That men should be turned out as college graduates who are practically ignorant and utterly indifferent concerning matters of government is almost a crime, and no man should be handed a diploma until he has been taught enough civics to vote intelligently.

Take a hypothetical case of two young graduates: One has spent from three to five hours a week for two years studying mathematics and the rest of his time on other purely scientific and technical subjects. The other man knows only enough mathematics and mechanics, say, to design a reinforced-concrete beam quickly and correctly, and knows about half as much as the first man does about other engineering subjects. Instead of that, he knows the elements of corporation finance, something about management of production, about marketing, and about accounting. He can read a financial paper intelligently and knows some of the reasons for success or failure of commercial projects. Also he knows how the government is operated and his own part in the operation, and he knows how to express his ideas clearly in speech and writing. Although his technical knowledge is less than that of the first man, he knows just where to look for needed information. Which one is more likely to be a success at the end of ten or fifteen years? Very likely the first man will be working for the second.

Birmingham, Ala., Feb. 7. R. L. MORRISON,
Engineer of Tests,
Pittsburgh Testing Laboratory.

For Construction Only at Reasonable Costs

Sir—As there is likely to be more or less active propaganda carried on to induce a large program of concrete road construction the coming season, particularly in connection with the prevailing unemployment problem, the attention of the engineering profession and of citizens generally should be brought to bear on the fundamental principles which should govern public improvements of this kind. Active steps should be taken to see that large expeditures are prevented unless conditions are in harmony with such principles.

Inasmuch as road construction of a permanent nature is almost entirely financed by bond issues, the cost of such work is thereby spread over future years and will have a direct influence on the future cost of living, in proportion not only to the present cost of the work built but to the rate of interest paid on such bond issues. Permanent improvements of this kind should only be built during periods of low cost, both for construction and interest on the bonds.

Consider, for example, the effect of the price of cement, as this is one of the principal items entering into road construction: During 1920 we have seen the price of cement f.o.b. mills go to approximately tripple its price in normal time. In Milwaukee during the past season we have had to pay quite generally $4.20 per barrel plus sacks, as compared with contract prices for season delivery in 1909, 1910, etc.

of $1.05 per barrel plus sacks. It may be safely assumed that 1920 road construction averaged at least double the normal cost.

Costs of coal and labor are important factors in the price of cement. Coal has recently collapsed in price and labor is rapidly coming down in cost and going up in efficiency. Therefore, cement costs should be materially reduced. It has, however, been commonly talked by cement agents and dealers that cement prices would not be reduced much for 1921, owing to the enormous demand for it on road construction.

As the country progresses with the process of deflation it is necessary for all lines of business to participate. If cement prices are encouraged to remain unreasonably high, not only will the country be burdened with an unreasonable cost for permanent road construction and other public work, but the retarding effect on much other necessary construction, such as housing, water powers, business buildings, etc., will be disastrous. We should therefore not be rushed into high-priced permanent public improvements under the false policy of merely relieving unemployment.

The country generally is facing an enormous burden of taxation. At this time we should go back to first principles in considering public expenditures, and authorize only such improvements as can be built in harmony therewith. To state the case of road construction briefly: Let us build permanent roads only where urgently needed, and then only at reasonable costs. RALPH E. NEWTON,

Newton Co., Industrial Engineers and General Contractors.

Milwaukee, Wis., Jan. 11.

Electrification Cost Data

Sir—In your issue of Dec. 2, 1920, p. 1067, appears editorial comment on an article in the same issue in which there is a description of the electrification of the C. M. & St. P. Ry. in Montana, Idaho and Washington. You claim that there is undue reticence in withholding the figures of the cost of operation, and that no actual figures have been made public.

I wish to call your attention to information on the subject as presented by the committee on electricity, American Railway Engineering Association, in the report of March 20, 1920, and printed in the *Proceedings* of the association in Volume 21, pages 197 and 251.

The report gives, for the road in question, the capital cost of the electrification of 440 miles of main line, with some comparative operating costs and other data. There are also given some specially prepared tables of electrical operating costs and expenses. From these figures as given I should think that an estimate of the total operating costs of the line could be made, by simply adding such of the other items of costs of operating as would be required.

Please allow me to quote two of the conclusions of the committee's report:

> Second: That such a system of electric operation will increase the capacity of a railroad from 25 to 35 per cent.
>
> Third: That such a system of electrification will probably prove economical as compared with steam operation, when the cost of reliable electric power and coal bear the relations one to the other that they do in the preceding table, as shown above the diagonal line, provided the railroad traffic is favorable to electric operation.

With reference to your complaint that the actual operating costs are withheld, it would be fair also to quote further from the A. R. E. A. committee report (page 268) as follows:

> As a result of these conditions any comparison of present electrical costs with steam prior to Jan. 1, 1917, is subject to very considerable corrections to bring the steam expense to the same basis of costs as the electric. The corrections are so numerous and subject to so many interpretations that the real facts cannot be made sure of at the present time. It is possible, however, to obtain from the annual operating statements certain operating costs which in many cases may serve as a guide in forecasting what economies may be obtained by the substitution of electric operation for steam.

Reviewing the subject of your editorial, however, with an open mind, it may be admitted that there are still lacking many figures on the cost of operation on the electrified portion of the C. M. & St. P. Ry. which it would be necessary to know in order to become convinced that the electrification of this line has been justified. For example: a reduction of 22½ per cent in the number of trains might mean a reduction of only about 5 per cent of the total cost of conducting transportation. The charges for engine and round-house men (I. C. C. acct. No. 21) and fuel, water service and locomotive supplies (I. C. C. accts. Nos. 22 to 25) are perhaps the only other principal items that would show a reduction due to electrification. Large as these five items are, in dollars, their sum is only about 22 per cent of the total cost of steam operation of the railroads of the United States.

Under the item of "maintenance of way and structures" there may be some reduction due to electrification, due to lessened rail and bridge renewals, all of which are yet to be determined. The main account would probably show some increase due to large cost of power distribution systems and power apparatus.

The capital cost of the line under discussion has been increased by $10,250,000. The gross revenue could not have been increased by the electrification, and with a line which would still have been operated below its capacity as a single track steam line, the fact that the electrification shows an increase in single track capacity may not be a significant accomplishment. F. T. HOWES,

Garrison, Mont., Jan. 9. Inspector, Engineering Department, Northern Pacific Ry Co.

Belle Isle Bridge Design Again

Sir—Your issue of Jan. 27 contains two articles which considered together are of very great interest. The first, on page 187, is entitled, "Pier Failure Wrecks Two Spans of Concrete Arch Bridge"; the second, on page 190, is entitled, "New Design for Belle Isle Bridge to Be Prepared." The first article describes the collapse of portions of two spans of the concrete arch bridge at Dayton, O., due to failure of the pier between them. The second article describes the great advantages which will result from the adoption of a reinforced-concrete arch design for the proposed Belle Isle bridge in Detroit.

The most interesting feature about the collapse of the Dayton bridge is the reason why all the spans did not fall in succession, on account of the thrust of the arches. The design, described in *The Engineering Record* of Mar. 24, 1906, does not make any provision against that kind of failure, since the piers are strong enough to take only the difference in thrusts due to different lengths of adjacent spans. The question is, is it safe to build a multiple-span arch bridge of any kind over a deep river or one where there is a large flow of ice, or where there is extensive navigation, unless the piers are founded on bed rock? This is the most important question to be answered in regard to the proposition for the concrete arch for the Belle Isle bridge at Detroit.

Next to this in importance is of course the relative cost and time required for completion as compared with another type of structure. In this respect the second article referred to, although not absolutely positive in its statements, appears to be in error on some important points. The original design is not a steel cantilever bridge faced with concrete, but in each span a number of concrete ribs reinforced with structural steel ribs. In this respect it would be a concrete arch, but steel cantilever arms were introduced. The use of these greatly facilitates erection, since the steelwork can be entirely erected and the concrete poured without the necessity of falsework from the bed of the river. Also a successive failure of all the spans if one span or one pier failed would not be possible.

It has been stated in newspapers that the total cost of the bridge as designed, including approaches, piers, roadways, etc., complete, would be about $5,000,000. In order to reduce this to $3,000,000, as stated in the second article above referred to, the cantilever arms would have to be omitted, thus saving $2,000,000. Figures of the structural

steel tonnage in the bridge are not at hand, but it is safe to say that all of the steel in the bridge would cost only a fraction of that sum.

The article is also in error in regard to the time of completion. With either type of bridge, the process would undoubtedly be to build all of the piers first. This is because there are pile foundations which must be completed in one operation. The next logical operation would be to construct cofferdams and build all the piers. While this is being done, all of the structural steel involved in the original design could easily be frabricated and delivered. With a much greater facility of erection of the original design, the time of completion, after the piers were built, would undoubtedly be greatly less than for the arch type.

The article is also in error in regard to the immediate and ultimate employment of about 50 per cent more local labor on the arch type. There would not be any more immediate employment, because the operation would be just the same until the erection of the spans was started. The spans themselves would probably involve more concrete in the arch type, but less forming on account of the ribs of the original design. It is safe to say that the labor would be just about equal on the erection of the spans.

The writer has no personal interest in the design of either the Dayton bridge or the Belle Isle bridge other than a general interest in any kind of bridge design, but is very much interested when he sees articles published in *Engineering News-Record* that are of greatly conflicting nature, and not in accordance with the facts.

J. T. N. HOYT,
Chief Structural Engineer for Albert Kahn, Architect.

Detroit, Feb. 4.

[Regarding Mr. Hoyt's comments on the news report of the Detroit council's decision to procure a new design for the Belle Isle bridge, it seems to be necessary to point out what should be obvious, that the report included no editorial opinion or coloring but gave only the news as to the action taken. In large part it quoted the ordinance adopted by the council. Through oversight, proper quotation marks were omitted. The term "steel cantilever bridge faced with concrete" is also quoted directly from the ordinance. However, whether this term is incorrect, or whether the commission design may fairly be called a reinforced-concrete cantilever, is perhaps more debatable than Mr. Hoyt's unqualified statement on the point implies.

As to the Dayton bridge accident, the importance of the case is patent. Yet if Mr. Hoyt's second paragraph is meant to suggest that it is not safe to build a multiple-arch bridge over the Miami River in the Dayton subsoil, it surely must be questioned. Its application to the Detroit River is of course quite another matter.—Editor.]

Design of Heavy Traffic Pavements

Sir—The very timely paper on "Considerations in Design of Heavy Traffic Pavements," by Prevost Hubbard, appearing in your issue of Dec. 30, p. 1264, was read with much interest. My attitude regarding the subject is in substantial accord with the conclusions drawn by Mr. Hubbard from his interesting series of experiments. My following suggestions are not controversial in nature, but are an amplification along lines suggested by Mr. Hubbard.

The text for my remarks is supplied by the last half of the opening paragraph which reads as follows: "With very few exceptions any well compacted soil will of itself support the heaviest conceivable traffic if its moisture content is properly controlled and if it is protected by a structure which prevents the displacement of particles at its surface . . ."

Such a supporting surface is, par excellence, a well consolidated macadam pavement. While unsuitable for the direct effect of motor traffic, its composition is such that it has the necessary rigidity to support and also the necessary flexibility to adjust itself to inevitable minor settlements of subsoil, without impairing its supporting value.

A well-constructed foundation of this sort has all the flexible qualities of an asphaltic concrete base course as advocated by Mr. Hubbard as an alternative for the prevailing concrete foundation. While admittedly macadam would not develop any slab or beam strength as investigated by Mr. Hubbard, I believe that a modified impact test on a sample of macadam, topped with an asphaltic surface mixture could be devised and furnished data that would admit of an intelligent interpretation.

Such tests should confirm the opinion held by many engineers that macadam under many conditions, particularly where ideal drainage conditions are unobtainable, offers a more adequate and suitable support than concrete under like conditions.

I believe that the increase in depth of concrete foundation or concrete surface pavements, beyond that which is found necessary in the heaviest traffic city streets, is both unscientific and unnecessarily costly, particularly if it is made the excuse for insufficient drainage provisions.

E. J. WULFF,
Senior Highway Engineer,
U. S. Bureau of Public Roads.

Washington, D. C., Jan. 24.

Credit Where Due

Sir—I note in your issue of Feb. 10, 1921, you have given a brief but very good description of one of the interesting improvement projects that the National Park Service has under way—the construction of a suspension mule bridge across the Colorado River in the Grand Canyon of the Colorado in Grand Canyon National Park, Ariz. At the close of this article you state that the bridge was designed by George "C." Goodwin of the National Park Service, and that the construction would be supervised by D. L. Reaburn, Superintendent of the Grand Canyon National Park. This statement is true; but in fairness to others whose efforts have contributed toward the solution of this rather unique problem I feel that their names should also have been mentioned in your article. I desire to say that although the bridge was designed under my direction and in accordance with my ideas, much credit is due Capt. V. A. Endersly, assistant engineer, National Park Service, who made most of the computations of the stresses and did much of the detail work of drawing and design. Credit is also due W. H. Peters, assistant engineer, National Park Service, then acting superintendent, Grand Canyon National Park, who assisted in securing the field data and helped Mr. Endersly in the office.

GEORGE E. GOODWIN,
Civil Engineer, National Park Service.

Washington, D. C., Feb. 15, 1921.

Wind Pressure on Inclined Surfaces

Sir—in *Engineering News-Record* of Jan. 20, p. 125, R. Fleming states that Spofford's "Theory of Structures" teaches "the law of the square of the angle of incidence" for the resistance of air upon planes inclined to the direction of the wind. A reference to the book in question will show that this statement is incorrect. Prof. Spofford gives the Duchemin and Hutton formulas as well as the theoretical one above referred to. He distinctly states it is probably wise to use one or the other of the two empirical formulas, and gives a table comparing the results of the three, pointing out the low values given by the theoretical as compared with the experimental. While the language used could easily be more emphatic in its favor of the empirical formulas (this part of the text was written in 1910), it certainly does not advocate the law of the square of the sine of the angle of incidence.

HALE SUTHERLAND,
Asst. Professor of Structural Engineering,
Massachusetts Institute of Technology.

Cambridge, Mass., Jan. 25.

Sir—The reading of the sentence Prof. Sutherland criticises is, "Some textbooks, Spofford's 'Theory of Structures' among others, still follow the teaching thus condemned." If the thought in mind when the article was written were restated it would read:

Some textbooks still follow the teaching thus condemned. Prof. Spofford in his "Theory of Structures," second edition, 1915, devotes a page to a formula making the normal pressure on an inclined plane surface,

from wind blowing horizontally, dependent upon the square of the sine of its angle of inclination. Prof. Spofford makes the formula derived the basis of his deductions for wind pressure upon curved surfaces. He states that "it probably gives too low results" for flat surfaces but is "probably more nearly correct" for curved surfaces.

The results for flat surfaces are not probably too low, they are at times absolutely wrong. If the formula were true aviation would be impossible. For a slope of 25 degrees the normal wind pressure would be one-fourth of that obtained by the well-established Duchemin formula; for a slope of 10 degrees it would be one-tenth as much. For a slope of 5 degrees and a horizontal wind pressure of 20 lb. per sq.ft.—a 70-mile gale!—the normal pressure on the inclined surface would be but 0.15 lb. per sq.ft. The formula has no place in a textbook unless it be emphatically condemned.

Furthermore, the "more nearly correct" results that Prof. Spofford obtained by the use of this formula for pressure on a cylinder are due to a compensating error, the use of the common but erroneous assumption that the effect of wind pressure on a cylinder is the summed effect of the pressures on an infinite series of tangential planes. If this assumption were true the Duchemin formula integrated between the same limits used by Prof. Spofford would give a pressure of 0.91, that on a plane diametrical section, or but little less than that on a vetrical plane; the best experimental data give a value of about ⅔. That Prof. Spofford's value (two-thirds) agrees closely with this figure is due, as said, to a compensation of errors.

A practicing engineer with but limited experience could easily conclude from the prominence given to the discredited formula in "The Theory of Structures" that he would not be far astray in following it. However, the present writer stands corrected in that he did not state clearly just what Prof. Spofford's lapse was. R. FLEMING.

New York City, Jan. 31.

Cost of State Road Surveys in Missouri

Sir—An article relative to surveys and plans for a state system of highways by the Missouri State Highway Department in *Engineering News-Record* of Jan. 13, 1921, p. 68, rather emphasized the statement that this work was being done for $100 per mile or less. I have made about 100 miles of these surveys and plans and cannot feel that the above statement reflects credit either on the State Highway Department or the State of Missouri. In addition I have conferred with a number of practicing engineers who have done work of this character by contract, and have been advised invariably that they have either failed to make a profit or have even suffered a loss.

My experience with the State Highway Department leads me to believe that their organization is neither more efficient nor better equipped than that of the practicing engineers doing highway work and I wonder if the following items of expense to the department are included in the actual cost: (1) Subsistence of field parties; (2) expense of field parties for field office; (3) cost of operation, maintenance and depreciation of motor cars; (4) a proportion of the division engineer's time and office expense; (5) a proportion of the general highway department office and overhead expense; (6) cost of completing the plans after they have been sent into the office of the department.

I should like to ask whether it is more economical for a state and a state highway department to endeavor to do at the lowest possible figure the preliminary work in connection with a system of highways, the aggregate cost of which would perhaps be $150,000,000, or whether it might be more economical to spend more time and money in the preparation of plans and doing preliminary work that might be reflected in a lower cost of construction and operation? At the beginning of the highway program engineers took considerable work at $100 per mile with the idea of getting the program initiated and because the law limited the department to that amount so far as paying engineers for the work by contract was concerned. Recently county authorities have been adding as high as $40 to $50 per mile to this amount in order to induce engineers to take the work. C. A. SHOCKLEY,
Shockley Engineering Co.

Kansas City, Mo., Jan. 26.

[It should be understood that the law limited the cost to the state to $100 per mile for the road surveys. This was explained in the article as well as the fact that county authorities were paying additional sums where the work could not be done within the prescribed limit of cost. The cost is stated to include both surveys and plans. Whether some other system might have been more economical did not enter into consideration, apparently, the Highway Department being governed by the law as passed by the legislature. A copy of Mr. Shockley's letter was submitted to the State Highway Department and the reply is to the effect that the article states the facts and that no special claims are made for what has been done, but that no good will be served by entering into a discussion.—EDITOR.]

Effect of Excessive Heat on Mild Steel and Concrete

Sir—In a letter reported in *Engineering News-Record*, Dec. 2, 1920, p. 1102, I referred to certain tests made in England showing the great reduction in the yield point and tensile strength of mild steel at high temperatures. I have now obtained precise information on the tests referred to, and in view of the fact that they throw much light on the behavior of reinforced concrete under fire gives the information herewith.

The tests were made by Prof. F. C. Lea, of Birmingham University, England, and communicated to the British Association at its meetings last August. The tests had for their object the determination of

1. The effect of rise in temperature on the yield point and tensile strength of mild steel.

2. The effect of rise in temperature on the compressive strength of concrete.

3. The protective insulation afforded steel by the concrete covering usually employed in buildings.

While due justice cannot be done to these tests in a brief space the following general information as to the results may be of interest:

1. The value of the yield point begins to fall at 250 deg C., and then falls rapidly until at 600 deg. C. it is but 20 per cent of the corresponding figure when cold. The tensile strength falls rapidly after 400 deg. C. is passed and at 600 deg. C the breaking strength is about 7½ tons per square inch. This is below the usual design for working stress.

2. Compression tests made on 1:2:4 gravel-concrete cylinders immediately after heating to temperatures up to 700 deg. C. indicated that the compressive strength fell off rapidly after 450 deg. C., and, after heating to 700 deg. C. the crushing strength is but 20 per cent of its value when cold.

3. Tests made on the temperature gradient in concrete cylinders from outside to inside indicated that it is roughly a matter of two hours before a temperature of 600 deg. C. would be communicated to steel at a depth of 1½ in.

In a fire of several hours' duration the protection afforded the steel by one or two inches of concrete would be very slight. From the descriptions given as to the duration and intensity of the Galveston fire it seems reasonable to imagine that both the concrete and the interior steel reached temperatures approaching 700 deg. C. Although the author has not had the opportunity of examining the destroyed structure yet, it seems possible to him that in view of the above tests failure would result under such conditions, whether the columns were reinforced with spirals or not. In the first fire it seems reasonable to believe that failure resulted from the inability of the steel and concrete to carry the stresses at such temperatures.

While the avoidance of sharp angles and corners in concrete is helpful in preventing spalling of the concrete under certain conditions, yet it seems that the main point is to use lower working stresses and a thicker protective coating on the steel. EDGAR A. CROSS.

High Point, N. C., Jan. 24.

HINTS FOR THE CONTRACTOR

Kitchen Boiler Makes Roller for Finishing Concrete Pavement

A 30-gal. kitchen boiler of the sort that has a longitudinal, electric weld instead of the riveted joints sometimes used, has been found useful on California road work as a roller for smoothing out concrete pavement before finishing the surface with the usual floating tool. A convenient handle for the roller is made with a ¾-in. galvanized pipe, using a piece long enough to reach across the pavement. To attach the handle, a piece of pipe about 4 ft. longer than the boiler is fitted with a tee at its mid point into which the handle can be screwed. Two right-angle bends are then made near each end of the branches from the tee and the two pipe ends are thrust through holes in the center of each end of the boiler.

Dragline Excavator Also Drives Piles in Reclamation Work

By A. W. Walker
Engineer, U. S. Reclamation Service

During the construction of drains in the Grand Valley Drainage District, Colorado, it has been necessary to install a great many highway bridges and canal flumes. Practically all of these structures, on account of soil conditions, have been built on pile foundations.

In order to save labor and equipment a dragline machine was used for a temporary pile driver. A set of

DRAGLINE EXCAVATOR DRIVING PILES IN COLORADO RECLAMATION WORK

leads was built with two 6-in. x 8-in. x 25-ft. timbers faced on the inside with 6-in. steel channels securely bolted with countersunk bolts. The outside corners of the 6-in. x 8-in. timbers were faced with ½-in. x 2-in. angle irons securely bolted. The timbers were braced the correct distance apart (size of a standard 2,000-lb. hammer) by heavy iron yokes made of 1-in. x 4-in. iron, some of the bolts which fastened the channel face irons to the lead timbers also fastening the yokes to the timbers.

At the top of the leads a 12-in. steel sheave was mounted, with housings made of ¼-in. sheet steel. Considerable care was exercised in mounting this sheave securely to make it and the leads rigid, this being accomplished by fitting 1-in. x 4-in. strap irons over the upper corners of the leads. The upper end of these strap irons had 1½-in. holes in them for the hoist-line clevis pin to fit in.

When in operation, one side of the leads is left open. A pile driver follower which fits in the leads and down over the top of the pile, holds the top of the pile in position. The leads are raised and held in a vertical position by the hoist line on the machine. The hammer is raised and dropped by the dragline which is a ½-in. cable substituted for the regular 1-in. line.

In driving piles for an ordinary bridge the procedure is as follows. In most cases the piles are driven before the drain is excavated.

1. The bucket is removed from the hoist line and the 1-in. dragline removed from the drag drum.

2. The ½-in. hammer line is placed on the drag drum and over the sheave at the upper end of the leads. In order to speed up operations the drag drum is lagged with 3-in. oak lagging which can be put on and taken off in a few minutes, as it is in two sections.

3. The clevis of the hoist line is fastened to the upper end of the leads which are then pulled up into position.

4. The hammer is fastened to the ½-in. line and then threaded into the leads. The follower is then threaded into the leads and attached temporarily to the hammer with a sling made of ½-in. cable.

5. The leads are then spotted over the pile point by moving the machine for approximate adjustment and raising or lowering the boom for final adjustment.

6. The leads are then swung around to the piles and with the hammer and follower lowered to the ground. The pile is fastened to the hammer with a rope sling. The hammer is raised to the top of the leads. The leads are raised to the point of the boom and all swung around into exact position. The pile is swung into the leads. The hammer and follower are lowered onto the top of the pile and the sling which attached the follower to the hammer is unfastened and the driving begins.

7. The material between the piles is excavated by the dragline as well as the material back of the piles. The bulkhead planking is placed, the piles are cut off, and the bridge deck put on. The necessary backfilling is completed by the machine.

Painting Signal Lanterns Decreases the Number Stolen

Lanterns left all night as danger signals on road barricades or where pavement repairs have been made were so frequently stolen from work carried on by the California Highway Commission that special endeavor was made to find some means of protecting them. After some experiment the best plan was found to be painting the lantern bases a bright red and stenciling over this the letters "C. H. C." Since this has been done loss from theft has greatly decreased.

NEWS OF THE WEEK

New York, February 24, 1921

Federation Organizes Waste Survey of Industry

Hoover Names Committee of Engineers To Carry On Nation-Wide Investigation of Conditions

At the meeting in Syracuse, N. Y., Feb. 14, of the executive board of the American Engineering Council, the governing body of the Federated American Engineering Societies, Herbert Hoover, the council's president, announced the appointment of the committee which will make a country-wide survey of industrial wastes. The personnel of the committee is as follows:

J. Parke Channing, (chairman) mining engineer, New York City; Dr. Ira N. Hollis, president, Worcester (Mass.) Polytechnic Institute; L. W. Wallace, newly appointed secretary of the American Engineering Council, Baltimore; H. R. V. Scheel, assistant treasurer, Brighton Mills, Passaic, N. J.; L. P. Alford, editor, *Management Engineering*, New York; George D. Babcock, manufacturing executive, Peoria, Ill.; F. G. Coburn, Bethlehem Shipbuilding Co.; Morris L. Cooke, consulting engineer, Philadelphia; Harrington Emerson, consulting engineer, New York; E. E. Hunt, formerly labor investigator for the Clothing Manufacturers Association, New York; C. E. Knoeppel, industrial engineer, New York; Robert Linton, mining engineer, Montana; Fred J. Miller, past-president, American Society of Mechanical Engineers; J. H. Williams, engineer, New York; Robert D. Wolf, vice-president, American Society of Mechanical Engineers, New York.

Territorial Organization Planned

Mr. Hoover is also a member of the committee and will take a leading part in the conduct of the waste survey. The scope of the undertaking was outlined by Mr. Hoover in an address at the council meeting, published in abstract on p. 342 of this issue. It is proposed to organize the engineers of the country on a territorial basis, each state having an engineering organization, with the American Engineering Council the executive organ of all.

The American Engineering Council, at its Syracuse meeting, gave formal approval to the action of the committee on procedure in requesting President Harding to appoint an engineer to the Interstate Commerce Commission; the committee was authorized to name six qualified engineers when requested so to do. Activity in behalf of the National Department of Public Works will be continued by the council through its public affairs committee. Endorsement was given to the policy or registration for professional engineers. The council's Russian affairs committee was made a new committee on international relations, the old personnel being retained.

An invitation from Philadelphia engineers to have the council hold its next meeting in Arpil in that city was accepted. The June meeting will be held in St. Louis.

The council recommended to President Harding that an engineer be appointed Assistant Secretary of War.

L. W. Wallace, New Secretary of Federated Societies

Lawrence W. Wallace, whose election to the secretaryship of the American Engineering Council, the governing body of the Federated American Engineering Societies, was announced in this journal last week, was born in Austin, Tex., Aug. 5, 1881. After graduation from the Agricultural and Mechanical College of Texas in 1903 with the degree of B. S. in mechanical engineering, he served a special apprenticeship with the Santa Fe Railway and then joined the faculty of Purdue University, becoming head of the department of railway and industrial management. Mr. Wallace is author of technical works, among them "Car

(*Continued on p. 356*)

New Secretary of the American Engineering Council

L. W. WALLACE

Concrete Institute Holds Active Meeting

No New Standards, But Special Attention Paid to Matters of Construction and Design

For the first time in a number of years the American Concrete Institute met last week in Chicago without such aid to registration as is given by co-ordinate bodies in session at the same time. Hitherto the annual conventions have generally, if not always, been held at the same place and about the same time as the Cement Show, the American Society for Testing Materials, or with road or housing conferences, all of which brought a number of men who helped boost the registration but who did not contribute proportionately to the attendance or discussion at the meetings. This year, however, the Institute was on its own, and every one of the 250 odd registered was there to attend the sessions or discuss papers and reports. As a result the meetings were longer and more lively than in any since the early days.

Committee Recommendations

No new standards were adopted by the meeting to go to letter ballot. One specification and one recommended practice had been prepared by the Committee on Concrete Products for block, brick and trimstone, but they were withdrawn by the committee in consideration of a proposed revision of form of all the standards of the Institute which is to be initiated this year. The Committee on Concrete Storage Tanks submitted some simple changes to its recommended practice of last year and the Committee on Concrete Houses presented a tentative draft of a specification. A proposed standard specification for reinforced-concrete chimneys by the committee of that name was referred back to the committee because of some evidence on the floor of lack of harmony among its members.

This absence of standards does not mean that the committees have been idle during the past year. On the contrary they have been exceedingly busy. Eighteen out of the twenty-two in the Institute reported at the meetings and most of the reports were more than merely of progress. Rather the indication is that concrete is not so simple or stabilized a material that it is possible to come before any body with a set of paragraphs which state that this and that are facts and things shall be done thus and so, only to have to appear the following year with some new assertions which require revision of the

standard. The committees seem to be showing a commendable desire to study the fundamentals of their respective subjects, to undertake research and apportion out detail investigation in the effort to establish the data on which a fair permanence of standards may rest. In this category may be noted particularly the committees on roads, bridges, metal forms, aggregate and concrete surfaces. The Committee on the Rockaway Fire cleaned up its work by presenting a final report on the fire in the concrete warehouse in Far Rockaway, N. Y., in 1916, a report which not only describes that fire but the tests on the building after repair and which discusses in some detail the effect of fire on concrete.

The Committee on Research for the first time presented a comprehensive report, which outlined a program for future work of the Institute in the field of investigation. It is proposed that the various subjects indicated, on which a number of different agencies are working more or less independently—and on some of which no work is being done—be portioned out to the committees of the Institute either for original study or for collation of material and coördination of effort. The move is a definite step forward in a systematic study of concrete.

Discussion on Design and Construction

Two major and one minor subdivision of the discussions before the convention may be made. The major subjects were design and construction; the minor, concrete products. In the old days of the Institute's predecessor the latter subject was of prime importance but of late years it has been allowed to lapse and the concrete product men have not felt altogether at home. This year they had one entire session at which their problems were discussed, particularly the question of fire protection and insurance risk of the concrete block structure. Progress was made toward a program of fire tests of this type of construction, to the end that the fire underwriters may have what they have not now, some definite information as to the fire resisting qualities in specific kinds of concrete block structures with blocks of a specific make and material. It is being recognized in the Institute that the factory-made concrete product is having a wider use and that it is necessary to provide some authoritative agency which can be a forum and a judge. The prospects are that in its future activities the Institute will devote more time to the concrete product.

Of the major subjects design, as in the past, held a large part of the program. Foremost among the papers was a joint presentation by Dr. H. M. Westergaard of the University of Illinois, and W. A. Slater, of the Bureau of Standards, of a discussion of "Moments and Stresses in Slabs." This is really a monumental piece of work, which will run into a hundred or more printed pages in the "Proceedings" of the Institute. Dr. Westergaard has made an analytical examination of the slab of unprecendental thoroughness and has applied the developed theory to the design of the reinforced-concrete girderless floor. Mr. Slater has studied a number of beam tests with the idea of discovering the laws of variation between observed and computed stresses and has applied the knowledge so gained to an analysis of most of the available full-size tests of concrete flat-slab floors. The complete paper when available should be an invaluable compendium of knowledge of the girderless floor.

Two papers on the design of columns were given, one by S. C. Hollister on bending moments in interior columns and the other by F. R. MacMillan on a new hooped concrete column formula. The former analyzes the moments of columns in a building due to various disposition of load on the floors and panels; the latter utilizes the steel compression due to concrete shrinkage and time yield and deduces a formula which gives a more economical column than do those in general use. Both papers present studies which doubtless are being used by the joint committee in its present preparation of a concrete specification.

Problems of the Concrete Builder

The other major field is one to which the Institute is devoting more and more attention, that is the problems of the concrete builder, who generally, of course, is a contractor. The Committee on Contractor's Plant continued its last year's study of building construction plants with a thorough analysis of the comparative merits of seven different kinds of layout and critical descriptions of three specific layouts. The Committee on Floor Finish outlined the proper methods of laying a concrete floor. Both of those reports had enthusiastic discussion by men of practical experience. Papers of direct interest to this field were the reports of a performance test of a concrete mixer by Prof. W. K. Hatt, two papers on concrete road construction equipment by F. M. Balsley and C. R. Ege, methods and formulas for coloring concrete by John W. Lowell, an investigation of the possibilities of using greater tolerances in sand and gravel grading for road concrete by Professor Hatt and R. B. Crepps and a study of shrinkage of stucco as it affects its placing by J. C. Pearson.

One report, that of the Committee on Standard Units of Design, is an attempt at harmonizing the two major subjects. It is a tentative recommendation of standard sizes and dimensions to be adhered to in building design in order to reduce the expense of unnecessary variations which the designer may put in with the idea of saving in material, but which on account of lack of uniformity may really add to the cost.

The Wason Medal was awarded to W. A. Hull for his paper "Fire Tests of Concrete Columns," presented to the 1920 convention.

Reports showed that the Institute is in a satisfactory condition with well up toward 700 members and a small balance in bank. Steps were taken at the convention to develop the scope of the society by the prosecution of a more definite plan of operations and better co-ordination of committee work. H. C. Turner of the Turner Construction Co., New York, was continued as president and W. P. Anderson of the Ferro Concrete Construction Co. of Cincinnati, Ohio, elected as junior vice-president, C. W. Gow of Boston holding over as the senior vice-president. Robert W. Lesley, after a number of years of service, has retired as treasurer and Harvey Whipple, the secretary of the Institute, was elected to take his place. His address is New Telegraph Building, Detroit, Mich. Abstracts of some of the more important papers and reports appear in this and later issues of *Engineering News-Record.*

Boston Garbage Disposal Contract Still in Force

Acting on the advice of experts, says Mayor Peters of Boston, Mass., in his annual message delivered Feb. 7, the city has rejected the proposal of the Boston Sanitary & Development Co. to cancel its contract with the city for garbage disposal and forfeit the amount of its $100,000 bond, and the subsequent proposal that the city increase its payment to the company by $25,000 a month. The Mayor states that he is prepared to take over and operate the garbage reduction works and proceed against the assets and bondsmen of the company for any losses the city may sustain in case the company defaults.

L. W. Wallace

(*Continued from p. 355*)

Design," in addition to special instruction books for railway educational departments.

He brings to the secretaryship of the council experience as a manufacturing executive, having served as assistant general manager in charge of production of the Diamond Chain & Manufacturing Co., of Indianapolis. More recently he has been director of the Red Cross Institute for the Blind in Baltimore, which provided vocational training for ex-service men. Mr. Wallace is a member of the American Society of Mechanical Engineers and vice-chairman of that organization's management section. He is now serving his third term as president of the Society of Industrial Engineers and is a past-president of the Indiana Engineering Society. He has served as vice-chairman of the Federation's committee on elimination of waste in industry and as the council's treasurer.

While located temporarily in the Engineering Societies Building, New York City, Mr. Wallace will soon transfer his office to Washington, where the American Engineering Council will eastablish permanent national headquarters in the McLachlen Building.

The New Administration of the Am. Soc. C. E.

In this and succeeding issues of "Engineering News-Record" will appear brief biographical sketches of the newly elected officers and directors of the American Society of Civil Engineers, as announced in the issue of Jan. 20, p. 140, following the annual meeting.

Otis Ellis Hovey, Treasurer

Otis Ellis Hovey, treasurer, was born at East Hardwick, Vt., in 1864. His English-Scotch-Irish ancestors settled in New England early in the seventeenth century.

He was graduated from Dartmouth College in 1885 with the degree of B. S. He served as engineer of the Hoosac Tunnel and Wilmington R.R. in 1885 and 1886 and as draftsman with the Edge Moor Iron Co. until the autumn of 1887, when he entered the Thayer School of Civil Engineering, at Dartmouth, from which he graduated with the degree of C. E. in 1889. During 1888 he had charge of a dam and several paper mill improvements in Massachusetts, on the staff of D. H. and A. B. Tower.

OTIS E. HOVEY

From early in 1889 until June, 1890, he was instructor in civil engineering at Washington University, St. Louis, Mo. He then became associated with the late George S. Morison, past-president, American Society of Civil Engineers, and took charge of Mr. Morison's Chicago designing office, where he served until 1896. During this period Mr. Hovey had charge of the designs and estimates of many bridges, including the Bellefontaine, Alton and Leavenworth bridges; also miscellaneous engineering work, including the railroad yard and structures for the St. Louis entrance of the C. B. & Q. R.R. He also designed and was resident engineer of a four-track bascule bridge in Chicago.

From January, 1896, until May, 1900, he was engineer of the Union Bridge Co., and had entire charge of a large variety of bridge and structural work. On the formation of the American Bridge Co. he became engineer of design, first at Pencoyd and later at New York; and in 1907 was appointed assistant chief engineer resident in New York, which position he now holds. His work has covered a wide field in steel structures, and he has devoted much time to the development and improvement of movable bridges and turntables during recent years. He had charge of the execution of the contract for the six emergency dams of the Panama Canal in 1911 to 1913. His duties have twice required trips to Europe and twice to Panama.

He served on the nominating committee of the American Society of Civil Engineers during the years 1911 and 1912.

Ira W. McConnell, Director

Ira W. McConnell, director, District 1, was born in Schell City, Mo., in 1871, and was graduated from Cornell University with the degre of C. E. in 1897. For two years he served as instructor in the College of Civil Engineering at Cornell, and for one year as professor of civil engineering at the Missouri School of Mines. As contractor's superintendent for the Nash-Dowdle Co. he was employed for two years on railway terminal work in Chicago and municipal drainage work in New Orleans.

For six years following he was in the U. S. Reclamation Service; four years as construction and project-engineer on the Gunnison tunnel and on the Uncompaghre project, and two years as supervising engineer of the Central District in charge of Reclamation Service work in Oklahoma, Kansas, Colorado, Nebraska, Central and Southern Wyoming and South Dakota. This assignment included such notable projects as the Pathfinder dam, the North Platte project, the Grand Valley project in Colorado, the Belle Fourche project in South Dakota, and the Garden City project in Kansas.

In 1909 Mr. McConnell became chief irrigation engineer for J. G. White & Co., New York, and later vice-president and general manager of the Idaho Irrigation Co. at Richfield, Idaho. In February, 1912, he was employed by the Stone & Webster Engineering Corporation as consultant in connection with the design, construction and operation of public utilities, water powers, railways, steam power stations, industrial buildings, etc., and in 1917 he became chief engineer for Stone & Webster.

In 1916 he made a five months' study of general business conditions in South America, the trip covering the developed portions of Brazil, Uruguay, Paraguay, Argentine, Chile and Peru. Mr. McConnell was works manager and assistant general manager for the American International Shipbuilding Corp. at the Hog Island Shipyard.

IRA W. McCONNELL

In 1918 he became vice-president of Dwight P. Robinson & Co., Inc., New York City.

John P. Hogan, Director

John P. Hogan, director from District 1 (New York), was born in Chicago in 1881 and was graduated from Harvard University in 1903 with the degree of A. B. and the following year from the Lawrence Scientific School with the degree of S. B.

From 1904 until 1906 he was engaged

JOHN P. HOGAN

in subway construction in New York as assistant engineer on the Rapid Transit Commission and resident engineer on the Brooklyn Rapid Transit Commission. He joined the engineering staff of the Board of Water Supply of the City of New York on the location and construction of the Catskill Aqueduct as assistant engineer in 1906 and served with that organization until 1917, reaching the grades of division engineer and acting deputy chief engineer. While division engineer he was in charge at various times of the construction of 28 miles of aqueduct and one reservoir, including the Rondout pressure tunnel at High Falls, N. Y., the Narrows flexible-joint steel pipe siphon leading from Brooklyn to Staten Island and the Silver Lake Reservoir on Staten Island.

Mr. Hogan entered the military service in May, 1917, as captain with the First (later named the Eleventh) Engineers, and served two years in France, with the A. E. F., ultimately reaching the rank of lieutenant-colonel, General Staff. He served as chief of the topographical service, Second Army, and as depty chief, topographical service, A. E. F. For this work he was decorated as chevalier of the Legion of Honor.

After terminating his military service Col. Hogan entered consulting practice with Col. William Barclay Parsons, of New York, his principal work involving the conduct of water power investigations in New York State.

Idaho Organization, in Year, Increases Seven-Fold

Growth of the Idaho Society of Engineers after it became the Idaho Chapter of the American Association of Engineers a year ago has increased the membership from 50 to 350. More than 100 delegates attended the first annual convention Jan. 10 and 11 at Nampa.

Action was taken requesting Congress to enact legislation providing for a continuation of Federal-aid for highway work and for a National Department of Public Works.

The chapter now has bills before the legislature covering amendments to the civil engineers' license bill; providing that the University of Idaho may be enabled to give extension courses in technical and liberal arts subjects; providing that at least one member of the Public Utilities Commission shall be an engineer; and giving the right to the State Board of Health to prevent the dumping of untreated sewage into streams. A better salary scale for engineers in state service is on the program.

The following officers were elected: President, Lee R. Cooke; vice-presidents, E. E. Moberly and J. H. Wilson; secretary-treasurer, Capt. E. F. Ayres, Boise; executive-committee, E. B. Darlington, Dr. C. N. Little and Barry Dibble.

Illinois Society Awards Prizes at Annual Meeting

Prize papers constituted a new development at the annual meeting of the Illinois Society of Engineers, held in Chicago, Jan. 26-28. Awards, limited to writers of not more than five years' membership for the express purpose of interesting the younger men, were made for the following papers: 'Keeping our Streets Smooth," by Harlan H. Edwards, city engineer, Danville, Ill.; and "Asphalt Pavements of the Future," by Allen Dimmick, of the Texas Co., Chicago.

Affiliation and co-operation with other engineering associations was the subject of prolonged discussion.

In an address on special assessment methods, Edgar B. Tolman, a Chicago lawyer, pointed out that if local improvement bonds are to be made attractive to bankers and investors it is necessary so to arrange the financing that interest will be paid on the prescribed dates. Failure to provide for such regularity, largely owing to the inexperience of local authorities, has resulted in greatly depreciating the market for such securities.

Resolutions

Resolutions as to public affairs included the following: (1) Suggesting that the state highway department should construct experimental sections of paving of different types; (2) that drainage of farm lands should be encouraged and extended; (3) that legislation should be passed more favorable to municipalities in financing waterworks projects; (4) that the state should accept the program of the U. S. Geological Survey for more rapid progress with the topographic mapping of the country and should appropriate $35,000 annually for this work; (5) that the new state administration should retain the present head of the State Department of Health; (6) that the Society endorses the principle of regulating public utilities by a state commission; and (7) that under present financial conditions the state should render liberal support to the University of Illinois.

A registered attendance of nearly 150 included about 90 members and set a high-water record for the meetings of this society, which has now a membership of about 270. Chairmen elected by the several sections include W. P. Bushnell, Quincy, Ill., drainage section; A. L. Webster, Wheaton, Ill., surveying section; W. S. Shields, Chicago, sewerage section, and C. C. Wiley, Urbana, Ill., road and pavement section.

Officers of the society for 1921 were elected as follows: President, Samuel A. Greeley, Chicago; vice-president, Robert I. Randolph, Chicago; secretary E. E. R. Tratman, Wheaton, Ill. It was voted to hold the next meeting of the society at Decatur, Ill., in January, 1922.

Amendments to New York Licensing Law Proposed

Several amendments to New York State's licensing law for engineers which was signed by the Governor in May, are proposed in a bill (No. 11 introduced in the Senate by Mr. Ferr Jan. 24. Among the principal changes are the requirement for a yearly renewal of the license, at a fee of $ and a clause defining "professional engineering" as follows:

"Professional engineering, as covered by this act, means the practice of the professional engineer who through technical knowledge gained by education and experience in one or more branches of that profession initiates, investigates, plans and directs the application of the resources of nature to the use and convenience of man; and who represents himself or herself to be such an engineer either through the use of the term engineer with or without qualifying adjectives or through the use of some other title implying that he or she is such an engineer."

To Co-operate with A. R. E. A. in Heavy Traction Studies

An arrangement to co-operate with the American Railway Engineering Association regarding progress in heavy electric traction has been made by the committee on heavy electric traction of the American Electric Railway Engineering Association. It is contemplated that the work will cover foreign as well as local practice.

Alaska Railroad Susitana Bridge Open for Traffic

Traffic has been opened over the Susitana River bridge of the Alaska R.R., according to press dispatches received from Anchorage, Alaska, Feb. 9. It is 1,200 ft. long, including a single span of 503 ft., the largest in Alaska. The bridge is located at mile 264. Its cost is estimated as $850,000. The opening of the bridge leaves less than 100 miles between the ends of rail this year.

Ask Bidders on Hydroelectric Equipment To Take Bonds

Mayor H. M. Caldwell, of Seattle, Wash., in a statement before the finance committee of the City Council, suggested that because of the dearth of construction throughout the country the successful bidders for the hydroelectric machinery to be used on the Skagit project might be willing to accept payment in city bonds. He also urged that the successful bidder be permitted to purchase an additional $1,000,000 of bonds at par, but that this be optional with the bidders. It is reported that certain prospective bidders have signified their willingness to accept bonds in payment for the equipment. The equipment which the city will buy includes two 35,000-hp. electric generators and exciters, etc. Bids will be opened Feb. 18.

Federal Aid for Roads Has Small Chance of Passing

(Washington Correspondence)

No additional appropriation for the Federal-aid road program is likely to be approved at the present session of Congress. A determined effort was made last week to attach as a rider to the Post Office Appropriation Bill the $100,000,000 appropriation for this purpose. The effort was unsuccessful. A bill providing this $100,000,000 appropriation was passed by the House by a large majority, as noted in last week's issue. The Senate action is attributed to the advocates of the Townsend bill, which provides for a national highway system.

Under the parliamentary conditions governing the vote taken in the Senate, a two-thirds vote was required in order to attach the Federal-aid proposition to the Post Office Appropriation Bill. Judging from that vote the House bill could be passed with a considerable margin were it possible to get that bill before the Senate. In the congestion which now exists and in view of the attitude of the committee, it is not thought probable that a vote can be secured in the Senate on the bill which passed the House.

New York Governor Indorses Joint Port Plan

In a message to the New York State Legislature on Feb. 16 Governor Nathan L. Miller urged the early passage by the legislature of an act authorizing the state to enter into a treaty with New Jersey forming a joint port district and port authority for New York harbor. He states that early adjournment probably will prevent full consideration now of the comprehensive plan formulated by the New York, New Jersey Port and Harbor Development Commission, but that the formation of the joint district should and can be effected at once. One paragraph in the message is especially interesting. It reads as follows:

"The Interstate Commerce Commission has decided that historically, geographically and commercially, the Port of New York is one port and on that theory denied the claim of New Jersey to a freight differential in its favor. Unless the State of New York now consents to treat the port as one port and to take the necessary steps to reduce excessive terminal costs, it must be prepared for a contrary holding by the Interstate Commerce Commission."

Use of Machines for Trenching Shown Water-Works Men

Moving pictures and lantern slides showing trenching machines, steam shovels and drag-line excavators at work digging trenches for water-works and sewers and available for other conduit trenching brought out a record attendance at the lunch and meeting of the New York section of the American Water Works Association in New York City on Feb. 16. Those showing views were the Bucyrus Co., the Parsons Co., the Marion Steam Shovel Co., and the Austin Machinery Corporation. W. R. Conard sent a paper reviewing the use of trenching machines at Camp Merritt and elsewhere during the war.

New Plans for Belle Isle Bridge

Proposed new plans for the Belle Isle bridge, prepared in accordance with a recent action of the city council calling for the presentation of the plans within 30 days and without cost to the city, were presented by Daniel B. Luten at a hearing Feb. 16, and the matter was taken under advisement by the council. The plans included two primary designs, of 16 spans and 18 spans, respectively. The total length of the bridge in each case is 2,195 ft., the same as provided by the original plans of the bridge commission. The first design is for an open-spandrel reinforced-concrete arch bridge with 95 to 160-ft. spans and 88-ft. wide, with cantilever sidewalks. The second design is for a solid-barrel arch bridge of 92 to 124-ft. spans, with spandrel walls and earth fill and without the cantilever sidewalks.

Bridge Commission Suggested

The appointment of a bridge commission to consider the matter and pass upon plans submitted was suggested by Esselstyn, Murphy & Hanford, the engineers who are employed by the city to make the detail drawings and supervise the construction, following out the general design of the bridge commission, which has been disbanded. The Detroit Section, Am. Soc. C. E., in a letter from its secretary urged the reappointment of the bridge commission to pass on all plans and advocated the commission's retention until the bridge was completed. Mr. Esselstyn favors reappointment of the original commission in view of its long and careful investigations.

Features of New Plans

In preparing his plans, Mr. Luten stated, the plans recommended by the bridge commission as well as the present specifications were followed closely. According to the proponents of the new plans they will reduce the cost of the bridge because of greater ease of construction, elimination of a large amount of steel and reduction of concrete. Four estimates were submitted, varying from $2,171,725 to $2,486,360, stated to be based on prevailing prices in Detroit with an allowance of 25 per cent. The designer's fee of 10 per cent of the successful bid would be paid by the contractor. Mr. Luten stated that the bridge could be built within two years.

Proponents of the commission or present design advocate competitive designs if the original plan is not to be adhered to. The contract which Esselstyn, Murphy & Hanford have with the city does not allow any latitude in changing the general design of the proposed bridge.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; Seventh Convention, Buffalo, N. Y., May 9, 10 and 11.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Annual Convention, Houston, Texas, April 27.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York; Spring meeting, Chicago, May 23-26.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago; Convention, March 15-17.

The Engineers' Club of Trenton, N. J., at its meeting March 10, will be addressed by Clifford M. Holland, chief engineer of the New York-New Jersey Tunnel Commissions, on "The Special Problems of the Hudson River Vehicular Tunnel."

The Society of Terminal Engineers held its monthly meeting in New York City, Feb. 15, devoted to a discusion of standard unit containers in freight service. The principal paper was delivered by Calvin Tomkins, chairman of the society's committee on containers, as a progress report. As a standard unit Mr. Tomkins favored the demountable motortruck body container. Discussion followed by F. L. DuBosque, superintendent of floating equipment, Pennsylvania System, New York, and J. H. Butler, loss and damage department, American Railway Express Co.

The New York Post, Society of American Military Engineers, is planning to hold its next meeting at 7:30 p.m., March 1, in the Engineering Societies Building, New York City. At the recent annual meeting Major-Gen. W. C. Langfitt, formerly chief engineer of the American Expeditionary Forces in France, where he served for more than two years, was elected president and Major Percy L. Barbour secretary of the post.

The Utah Irrigation and Drainage Congress, at its fourth annual convention in Salt Lake City, Jan. 17-18, elected the following officers: President, Dr. F. S. Harris; first vice-president, R. E. Caldwell; second vice-president, E. A. Porter; third vice-president, Ephraim Bergeson; secretary-treasurer, U. A. C. Logan.

The Seattle (Wash.) Section, Am. Soc. C. E., at its annual meeting Jan. 31, elected the following officers: President, T. E. Phipps; vice-president, Bertram D. Dean; secretary-treasurer, Frank H. Fowler.

The Wyoming Engineering Society at a recent meeting elected the following officers: President, Ambrose Hemingway; vice-president, James Wisda; secretary-treasurer, Henry Watson.

PERSONAL NOTES

ROGER M. FREEMAN, for the past three years supervising engineer Bureau of Yards and Docks, U. S. Navy, has opened a consulting office in New York City as construction engineer, specializing in the design and construction of industrial buildings, steel plants and power plants. He is a graduate of the Massachusetts Institute of Technology and after service as assistant engineer with his father, John R. Freeman, Providence, R. I., on the design of large hydro-electric developments in this country and Canada, joined the staff of the Turner Construction Company. He left that organization to become associated with the Chase Co., Inc., of Waterbury, Conn., to build up an organization and to direct the design and construction by force account of about $2,000,000 worth of industrial buildings, mostly reinforced-concrete factories. Two years later he joined the Bureau of Yards and Docks of the Navy where he was in charge of the construction of a number of important forging and heat-treatment plants, the largest being that of the Erie Forge & Steel Co., of Erie, Pa., costing about $9,000,000 Lately he has been in charge of the design and construction of the armor plate and gun-forging plant for the Navy Department at South Charleston, W. Va., costing about $20,000,000. At its peak the organization for this work included about 50 draftsmen and engineering assistants and 1,500 men in the field.

HIRAM D. PHILLIPS, assistant division engineer, Massachusetts State Department of Public Works, Bureau of Highways, has been appointed engineer of District 2, Franklin and Hampshire Counties, Conn.

CHARLES F. SCHEIBLE, manager of the Hunter Construction Co., has been appointed Director of Public Service, Youngstown, Ohio.

MAJOR EDWIN H. MARKS, Corps of Engineers, U. S. A., has been relieved from duty in the office of the Chief of Engineers and ordered to Duluth to take charge of the engineering division in that area.

CLARENCE M. BROOKS, formerly engineer, Division 4, New Hampshire State Highway Department, has been appointed highway commissioner of Vermont.

ERNEST M. LEVY, formerly resident engineer on the Conway-Vilonia Road, has been transferred to the position of office engineer of the Parkes Engineering Co., Pine Bluff, Ark.

R. N. KINNAIRD, with the Des Moines Water Co., previous to the sale of that company to the city, announces the opening of a consulting office in the Iowa Building, Des Moines, specializing in water supply and purification, municipal sanitation, sewerage, power plant engineering, coal mining, coal, sand and gravel preparation and handling.

SID SMYTH, for the past two years engineer of Cochise County, Ariz., has been reappointed for a two-year term.

WILLIAM C. HAHN, vice-president and assistant manager Kirchner Constructoin Co., Cincinnati, Ohio, died Feb. 5 at Cincinnati. He was 56 years old and entered the contracting business 35 years ago as foreman under Mr. Kirchner. A number of streets in Cincinnati and vicinity were built under his supervision, also the coagulating basins and the settling reservoirs of the new Cincinnati waterworks at California, Ohio.

MAJOR W. B. HARRISON, Corps of Engineers, U. S. A., has been ordered to the Canal Zone to serve with the 11th Engineers.

E. H. GROOT, assistant engineer under the U. S. District Engineer on the completion of the construction work and installation of machinery at Dam No. 43, Ohio River, West Point, Ky., has been placed in charge as assistant engineer of the Louisville & Portland Canal, including shops, dry dock and lock and Dam No. 41, the maintenance and operation of Dam No. 43 and the central engineer's depot for the Louisville district at Pilchers, Ky.

MAJOR ALLEN P. COWGILL, Corps of Engineers, U. S. A., has been placed upon the retired list by reason of physical disability incident to the military service.

R. O. COMER, formerly designing engineer in the engineering department,, Board of Port Commissioners, New Orleans, La., has been placed in charge of canal and lock work on the Navigation Canal.

J. H. CHUBB, northwest manager, service bureau, Universal Portland Cement Co., has been made manager of the service bureau, Chicago, succeeding to the position vacated by J. H. Libber-

PAUL STERLING, formerly maintenance engineer, New York, New Haven & Hartford R.R., Lines West, is now assistant to the engineer maintenance of way, with headquarters at New Haven, Conn.

W. G. PEARCE, formerly with Chipman & Power, consulting engineers, Toronto, Ont., has been appointed assistant designing engineer of the sewer section, Department of Works, Toronto.

J. R. HUNT has been appointed road engineer of Wyoming County, W. Va.

RONALD MCKINNON has been appointed city engineer of Sydney, N. S., succeeding N. K. Hay, resigned.

NORMAN J. GOEBEL has been appointed engineer for the board of water commissioners, Oshawa, Canada.

ton, who has gone with the Ge Chemical Co., New York City.

MAJOR LEON E. LYON, Cor Engineers, U. S. A., has been assi to the Lighthouse Service to sup tend construction and repair of aid navigation in the Philadelphia li house district.

E. S. SMITH, formerly Director Public Service, Youngstown, Ohio, h been appointed chief engineer of Ohio State Highway Commission.

J. R. ANDERSON and E. M. A DERSON have organized the firm Anderson & Anderson, architects an engineers, with offices at Wheelin W. Va.

C. F. GRAESER, formerly resident engineer on design and construction of municipal improvements with W. B. Saunders, consulting engineer, Helena, Mont., is now assistant engineer, Minnesota Highway Commission.

W. A. HENDRY of Halifax, N. S., has been appointed chief engineer, Nova Scotia Highway Board.

H. F. MCFARLAND, JR., formerly chief engineer in charge of the location and construction of the Wichita Falls, Ranger & Fort Worth R.R. from Dublin, Tex., to Breckinridge, has been appointed chief engineer of the Wichita Falls & Southern, with headquarters at Graham, Tex.

OBITUARY

E. S. DRAPER, principal assistant engineer Boston & Albany R.R., died Feb. 6 at Boston, Mass. He was born in Wayland, Mass., in 1883 and was graduated from Tufts College, 1904. In 1905 he entered the employ of the Boston & Albany R.R., leaving that company in 1912 to become draftsman with the Stone & Webster Engineering Corp. at Boston. In 1913 he re-entered the employ of the Boston & Albany R.R. and served as assistant engineer, later engineer of structures and in May, 1920, was appointed principal assistant engineer.

ELIOT N. SMITH, for nine years on the engineering staff of the Catskill aqueduct, Board of Water Supply of New York City, died last week. He was graduated from Oberlin College in 1900 and received his engineering degree from Harvard University in 1904. After service with the New York Rapid Transit Commission from 1904 to 1906 he was appointed assistant engineer Board of Water Supply, New York, engaging in design, estimates and preparation of contracts for the Catskill work. Leaving the water board in 1915 he became associated with the firm of Smith, Hauser & McIsaac, contractors of New York City, and later was appointed supervisor of the bureau of engineering of Nutley, N. J.

Building Trades Employer and Employee in Joint Conference See Need For Co-operation

Philadelphia Meeting Results in Conviction That Each Element Must Yield, to Revive Construction

In the hope of coming to some common agreement whereby the cost of building construction can be so lowered as to stimulate a revival of construction, the industrial relations committee of the Philadelphia Chamber of Commerce called into conference for four days last week all elements in the construction industry. Each element had adverse criticism to offer regarding the others, and the sum total of this criticism is embodied in a statement of conclusions to which the conference came. Knowing exactly what things were wrong, the conference ended with the adoption of a resolution—whose motion to adopt was made by an employer and seconded by the president of the building trades council—recommending the holding of immediate additional conferences between labor, employers, material men, financiers, architects and engineers with a view to reaching an understanding that will cause the immediate release of contracts for building construction. Local conferences throughout the United States were also recommended and it was urged that a national conference be effected immediately for the stabilization of views and purposes in the building industry, based on the facts and conditions presented at the Philadelphia conference.

Conclusions

The conference arose out of the fact that building construction in Philadelphia, as well as elsewhere, is practically at a standstill. It was also observed that with a revival in construction other basic industries would be greatly improved. The conclusions which the conference reached were: (1) That current costs of construction materials still remain much higher as compared with pre-war costs and as compared with the average of all other commodities; (2) that current construction labor costs have not had proper adjustment to accord with present conditions; (3) that practices and conditions surrounding the financing of building construction require modification; (4) that relations between employers and employees call for improvement and stabilization in order to secure continuity of operations in all building construction; and (5) that employers and contractors have not progressed to the needed extent in effecting reasonably prompt deflation of values throughout the construction industry (and all stages thereof from raw materials to finished product) including their own overhead and profits. One of the chief accomplishments of the conference was the harmonizing of employer and employee, and the impression of each of the necessity for co-operative, constructive thinking and acting.

In order to reach the above conclusions, bankers, material men, representatives of statistical bureaus who shed light on living costs, etc., employers of building construction, labor and those skilled in the building trades participated in the conference. Practically two days were devoted to an analysis of the situation by employers of building labor and the skilled mechanics themselves. Contractors based their analysis on an examination of their own companies' conditions, and in almost every case it was charged that there was a decided decrease in efficiency which had had almost as much to do with the increased cost of building construction as the rise in wages. The other factor which they agreed had kept up building costs was the high price of materials which had not suffered its proportionate deflation.

Labor's Point of View

To meet this argument the representatives of labor asserted that their short working year—200 days on the average—would not, in justice, allow them to consent to a reduction in wages. However, they agreed that there had been a marked decrease in the general efficiency of their numbers, but laid it in every case to a war condition which forced them to dilute their skilled forces by the inclusion of barbers, shoemakers, clerks, and, in fact, every other class of worker except the skilled mechanic.

Prominent among the suggestions made at the conference as to what could be done to improve conditions in the building industry was a report made by the subcommittee on wages and building costs of the general committee of employers and building trades of the Philadelphia Chamber. It embodied an exhaustive study of the decline in business, cost of living, business failures, unemployment, a decline in wholesale prices, the rent situation, and other considerations, and it proposed a rate of wages in the building industry which it deemed a just wage based upon an expected further decline in commodity prices, and a wage which in general is 23.9 per cent lower than the existing rate. Inasmuch as the committee indicated that labor's share in the cost of building is approximately 40 per cent, such a decrease would mean a 10 per cent reduction in the cost of building. The present rate, weighted in proportion to the numbers employed in each trade, is at present, based on the 1920 wage agreements, $1.16 per hour, whereas the new rate, weighted in proportion to the numbers employed in each trade, is 88c. Though this shows a reduction of 23.9 per cent over the 1920 rate, it is an advance over the 1914 rate of 73 per cent. Further recommendations of the committee in connection with the suggested rate for 1921 were that double time be paid for work on holidays, Saturday afternoons and Sundays and for time after four hours of overtime. It also suggested that one and one-half time for overtime not exceeding four hours be paid, that the working week be 44 hr. and that 10c. an hour additional be given for night shifts.

Indicative of the desire of labor, despite its attitude on the wage-reduction question, to assist in the stabilization of construction, was its ready assent to sit with employers and other elements in the building industry in further conference. It agreed that its efficiency could be materially increased, and quickly, through the process of elimination and of education. It also showed itself in a disposition to accept a wage reduction in the event that material prices could be lowered much further and that contractors would be willing to forget their profits for the moment. That such a situation will be arrived at in the further conferences was indicated in the promise of one brick manufacturer to forget, in selling his brick, even the interest upon his $500,000 plant, and the promise of one investing builder that he would put his construction organization at the disposition of labor and would build 100 six-room two-story houses entirely without profit.

The conference was presided over by Ernest T. Trigg, chairman, industrial relations committee of the Philadelphia Chamber of Commerce.

Illinois Receives Highway Bids

The Illinois State Highway Department opened bids Feb. 18 for approximately 150 miles of concrete roads. The interest displayed was widespread, more than sixty contractors from Kansas City, Mo., to Muskegon, Mich., submitting tenders. The total attendance of contractors and material men at the opening of bids was about 800. The bids for construction of 18-ft. roadway of 7-in. concrete, under the Illinois specifications ranged from $26,000 to $45,000 per mile, on the basis of the cement being furnished by the state. Details of the prices and firms submitting bids appear in the construction news section.

Pennsylvania Opens Road Bids

Bids submitted to the Pennsylvania Highway Department Feb. 18 for the construction of approximately 104 miles of highway, mostly reinforced-concrete, were lower than those for some of the projects last year. The detailed figures are not yet available. The opening required more than 4 hours and contractors from all parts of the state were present, in addition to outside firms. More than 270 sets of plans for the contracts had been issued by the State Highway Department and about 130 bids were received.

Senate Immigration Committee Reports on Proposed Bill

On Feb. 15, the Senate Committee on Immigration reported the modified Dillingham bill as a temporary measure, expressing an opinion that no emergency existed which warranted a general prohibition of European immigration. The committee at the same time reported adversely upon the Johnson bill, designed to prohibit European immigration, which passed the House of Representatives several weeks ago.

The Dillingham bill provides for limitation of immigration upon a percentage plan, the limit fixed being 5 per cent of the number of natives of any country resident in the United States in 1910. Not more than 5 per cent of such a number is to be admitted in the course of a fiscal year. The bill is supposed to go into effect April 1, and remain in effect for 15 months. Through the percentage plan, the committee believes that not only will immigration be materially reduced, but that a greater proportion of immigrants who have demonstrated their assimilability will be secured.

The report dwells on the shortage of common labor and farm labor which is estimated at 4,000,000 July 1, 1920. It says it can see no injury done to a nation of 105,000,000 people by the receipt during the last six months of 1920 of 412,000 immigrants. The report also holds that immigration is affected by economic conditions and in the present depression there need be no fear of a flood.

In the hearings which the committee has been conducting upon the various proposed immigration bills, representatives of many industrial, civic, manufacturing and other concerns have been invited to present arguments. Among these was the National Federation of Construction Industries, which recently appeared before the committee in opposition to the Johnson bill presenting figures to show that there was no fear of an emergency inasmuch as all the steamers now plying the trans-Atlantic trade could, in the course of a year, bring but 1,052,000 steerage and third-class passengers to the United States, assuming that each vessel made ten round trips per year.

Production Decreases As Working Week Is Shortened

According to an investigation recently made by the National Industrial Conference Board into 436 manufacturing establishments in which 373,536 workers were employed, 87.2 per cent of the industries inquired into showed a reduction in per-capita production when the working week was shortened to 48 hr. or less. Eight and seven-tenths per cent of this number were able to maintain per capita output and 4.1 per cent actually increased. In the metal manufacturing industry, of 117 plants investigated 9 plants increased per capita output and 16 maintained it.

Bank Investigation by Lockwood Committee Denied by Senate

The Lockwood joint legislative committee which made an investigation of the housing situation in New York City recently has been denied increased power to investigate banks and insurance companies. The amendment to a resolution to such effect was defeated Feb. 15, by the New York State Senate.

The amendment sought by the Lockwood Committee, which was defeated, would permit the committee to investigate the form of organization and the business, practices, management, affairs and investment of all corporations and associations that have among other things the power to invest their funds in real property, or in bonds secured by a mortgage on the property in so far as the same may, in the judgment of the committee, bear upon the past, present, or future conditions of housing, building or loaning conditions in any of the cities of the state, insofar as such an investigation may, in the judgment of the committee, be pertinent to any recommendation for legislation affecting housing. The committee believed that, through such investigation, it might open channels for the financing of building operations.

Tax Exemption Bill Passed by New York Aldermen

An ordinance exempting from taxation for a period of ten years dwelling houses erected in New York City from April, 1920, to April, 1922, was adopted Feb. 15, by the New York Board of Aldermen. The ordinance provides an exemption up to $5,000 for a single house and $10,000 for a two-family house. Apartments are exempted at $1,000 a room up to five rooms. The ordinance must have the approval of the Board of Estimate and Apportionment before it becomes a law.

Ford Plant in Highland Park Increases Working Staff

Approximately 4,000 additional men have been added to the working force of the Highland Park, Mich., plant of the Ford Motor Co. This increases the force to 14,000 men. It is understood that a steady increase in the number of orders for new cars caused the additional men to be employed. All of the 4,000, it is reported, are married men who have not worked since the plant shut down Dec. 23.

Metal Trades Open Shops Idle Two Months

More than 100 factories of the Allied Business Metal Industries, New York City, resumed operations last week after almost two months of idleness, brought on by a lockout following a demand from the laborers of a decrease from 48 to 44 hr. per week. The shops re-opened upon a basis of no reduction in wages, 48 working hr. per week, and no discrimination against union or non-union men.

Wage Reductions Promised in Building Industry

One hundred building contractors of Denver, Col., members of the master builders association, voted recently to propose to the state industrial commission that a general reduction of 20 per cent in wages of those employed in the building crafts be made. Under the plan the reduction would become operative at the expiration of the 30-day period fixed by the state industrial law for giving such notice. Approximately 3,500 building craftsmen would be affected, union officials estimate. Of this total less than 25 per cent are now steadily employed, say the union officials.

General contractors and subcontractors of Chattanooga have served notice that, on April 1, the wages of all skilled labor in the building industry will be reduced 20 per cent and that " a day's work for a day's pay" will be demanded from their employees. The statement was signed by thirty-three contractors and was transmitted to the manager of the industrial board of the chamber of commerce.

Four Bethlehem Shipyards Cut Wages 10 Per Cent

Four yards of the Bethlehem Shipbuilding Corporation have undergone a 10 per cent wage reduction on all hour and piece work according to an announcement recently made by the secretary of the Atlantic Coast Ship Builders Association. The yards affected are the Fore River plant, Quincy, Mass.; the Moore plant, Elizabeth, N. J.; the Harlan plant, Wilmington, Del.; and the plant at Sparrows Point, Md.

Further Retrenchment Seen in Railroad Circles

News dispatches indicate that four shops of the New York Central R.R., employing about 3,600 men, have been closed temporarily. The shops are those situated at West Albany, N. Y., Elkhart, Ind., Collinwood, Ohio, and Depew, N. Y.

Approximately 900 workers of the Pennsylvania Railroad Co. were furloughed during last week according to an announcement made from Altoona, Pa., the Altoona car equipment department being the hardest hit. In this shop 511 men were furloughed. It is said there are thousands of cars on the sidings awaiting repair, but business conditions are such that there is no demand for them and nothing will be done, officials say, until the demand is apparent.

According to press reports the East End shops of the Norfolk & Western Ry., situated at Roanoke, Va., have closed down until March 1 because of lack of work. Approximately 1,500 men are affected.